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Full Name of Author — Nom complet de l'auteur

BRUCE UDITSKY

Date of Birth — Date de naissance

MARCH 26, 1984

Country of Birth — Lieu de naissance

CANADA

Permanent Address — Résidence fixe

9824 188 ST.
EDMONTON, ALBERTA
T5T 3P3

Title of Thesis — Titre de la thèse

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Name of Supervisor — Nom du directeur de thèse

DR. ROBERT MULCAHY

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FEUERSTEIN'S INSTRUMENTAL ENRICHMENT PROGRAM, VOCATIONAL SKILLS, AND ADOLESCENTS WITH A MILD DEVELOPMENTAL DELAY

by

BRUCE UDITSKY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance a thesis entitled Feuerstein's Instrumental Enrichment Program, Vocational Skills, and Adolescents With a Mild Developmental Delay submitted by Bruce Uditsky in partial fulfilment of the requirements for the degree of Master of Education.

pMulcahy
Supervisor

Fern Smart

Date Oct 10/84

ABSTRACT

The present study examined the relative effectiveness of Feuerstein's Instrumental Enrichment Program (FIE) (Feuerstein, 1980) on vocational performance when applied to young adolescents with a mild developmental delay. Vocational performance included specific skill demonstration on a job related task and general work related behaviors in 'vocational' classrooms. This study concludes the first part of an intended two-three year study on the applicability of FIE with the subject population.

Subjects were all first year students attending a segregated vocationally based secondary school for individuals identified primarily as having a mild developmental delay. A total of 24 students participated with fourteen randomly selected from the three regular instruction (RI) classrooms (5, 5 and 4) and ten students from two FIE classrooms (5 and 5) taught by trained FIE teachers. The control group (RI) ranged in age from 11.7 to 13.2 years with a mean of 12.407 (SD .50). The experimental group (FIE) ranged from 11.6 to 12.9 with a mean of 12.320 years (SD .48). I.Q. scores for the RI group ranged from 60 to 91 with a mean of 71.929 (SD 7.75). The I.Q. scores for the FIE group ranged from 56 to 79 with a mean of 66.9 (SD 7.80). Of the control

subjects 6 were female and 8 male. The corresponding numbers for the experimental group were 5 and 5 respectively. The RI and FIE groups did not differ significantly with respect to age, I.Q. or any of the other critical pretest measures.

The control group received the regular school curriculum consisting of academic classes in the morning and vocational classes in the afternoon. The experimental group received FIE instruction four to five times per week for approximately one hour in duration during academic time periods thereby foregoing some academic instruction. Afternoon classes were the same as for the RI students. The experimental group completed the first two FIE instruments, Organization of Dots and Orientation in Space I.

All subjects were assessed prior to the mid-point and at the end of the school year on a series of tasks involving the discrimination of errors and construction of electronic circuit boards. This job related task was designed to be sensitive to possible FIE effects as subjects required the same cognitive skills to complete the tasks as FIE is supposed to remediate. Students were also assessed by the vocational teachers using the school's vocational rating scale for general work related behaviors. A number of individual ratings were analysed separately for possible specific effects. Wide Range Achivement Test (Jastak and Jastak, 1978) and Schonell Reading (SLR) scores

taken by the school at the same points in time were also available and considered in the analysis.

This study did not produce any significant findings when comparing the FIE and RI groups on all posttest measures. A small number of significant findings were found on pre to posttest comparisons but these varied between groups with no specific trend or support for one condition over the other. The most consistent pre to posttest differences occurred on the achievement tests suggesting that the loss of academic subject time did not adversely effect the experimental group. The results are discussed in terms of possible explanations for the lack of significant findings and implications for further study and utilization of FIE.

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Chapter I

INTRODUCTION

It has been strongly suggested that the primary purpose of schooling is performance on "out-of-school" tasks (Brown, Branston, Hamre-Nietupski, Pumpian, Certo and Gruenewald, 1979) and that an implied benefit of education is the acquisition of vocational skills which enhance the opportunities for employment (Wilcox and Bellamy, 1982). The generally stated limitations of special education in achieving the above propositions for students with a mild developmental delay (Mithaug, 1981) has contributed to an increasing interest in theories and intervention strategies that focus on the development and training of intellectual skills so as to reduce significantly "retarded performance" (Sternberg, 1981; Brown and Campione, 1977). The major overriding hypothesis is that the acquisition of intellectual skills and strategies will result in a generalized ability to perform in and learn from the natural environment (Feuerstein, Miller, Hoffman, Rand, Mintzker and Jensen, 1981). Other factors supporting this conceptual trend include dissatisfaction with traditional concepts of intelligence as an immutable and singularly predictive entity (Feuerstein et al,1981; Brody and Brody, 1976), the difficulty in successfully demonstrating generalization (Borkowski and Cavanaugh, 1979), and the necessity to develop improved educational methods for the

adolescent with substantial learning difficulties (Feuerstein, 1980; Alley and Deshler, 1979).

Feuerstein's Instrumental Enrichment (Feuerstein, 1980) is one of a number of programs designed to teach "thinking skills" such as DeBono's (1981) Cort Thinking and Whimbey and Lochhead's (1980) Analytical Reasoning Program. However it is, perhaps, the only one specifically oriented to the special or compensatory education population. In essence the program enables the "culturally deprived" learner to develop the cognitive structures that provide the basis for an increased learning potential. The underlying construct of FIE is the concept of cognitive modifiability (i.e., learning how to learn). The concept of cognitive modifiability suggests an etiology for limited performance with accompanying methodologies for assessment and intervention. While there are many theories of intelligence and intervention few contain the overall model coherency of Feuerstein's program.

Feuerstein (1980) proposes a common proximal cause of "retarded performance", a lack of mediated learning experiences (MLE) during development which constitutes a state of cultural deprivation resulting in a diminishment of appropriate cognitive structures for adequate learning. MLE's are the primary psychological means of cultural transmission whereby a mediator, usually a child's primary care giver, interprets and transforms environmental events

and interactions, past, present and future, through a variety of modalities to the child. This action is necessary to the child's understanding and reasoning, critical components in the cognitive development of the child. A lack of sufficient MLEs may be a result of a multitude of factors including environmental conditions, parental inadequacy or philosophy of child rearing, and child inherent problems. Regardless of the source or sources accountable for insufficient MLEs, Feuerstein's (1980) Instrumental Enrichment program is reportedly designed to compensate for impeded development except in those instances when a child is assessed as not having adequate learning potential (Feuerstein, 1979). FIE consists of a series of fifteen instruments, essentially content-free paper and pencil exercises organized into units. Completion of these exercises in combination with appropriate teacher contributions to bridge the learning from the exercises to everyday needs and examples, results in the development of cognitive structures that account for modifiability. In addition to this major goal Feuerstein (1980) lists six subgoals (Appendix A) including the correction of deficient cognitive functions, establishment of intrinsic motivation, the development of insight and improved self-perception as a generator of knowledge.

There is purportedly an increasing proliferation of FIE programs (Haywood and Arbitman-Smith, 1981; Maynard,

1979) which is also true for the cooperating school in this study, as it is expanding its current FIE program to all first year students. Only one major research study on both the more immediate and long term effects of FIE has been reported by Feuerstein and his associates (Feuerstein, 1980; Rand, Mintzker, Miller, Hoffman and Friedlander, 1981). This original study was conducted on a group (N=218) of culturally deprived adolescents whose parents emigrated to Israel from North Africa. Assessment after completion of the two-year program demonstrated significant posttest differences for the FIE students on standard measures of intellective functioning with only a few significant differences on nonintellective measures. These included significant differences in 2 out of 12 achievement subtests and three measured classroom particiption factors (intepersonal conduct, self-sufficiency and adaptiveness to work demands). A follow-up study conducted two years later by Rand et al. (1981) using Israeli army intelligence, Hebrew and other army rating tests found that the initial FIE gains were sustained on the intelligence test. The control group did significantly better on the language test and no differences were found on the remaining tests. Haywood and Arbitman-Smith (1981) report on some initial data from FIE programs in the United States with some promising trends and some negative implications, particularly for students with a mild developmental delay.

This recent study was conducted as a means of addressing some of the issues indicated above, one being the simple lack of published research studies. Further, the successful results generated to date have been on static measures of intelligence of which Feuerstein (1979; 1980) is highly critical. Static intelligence tests should not be considered as a viable means of determining learning potential or the impact of FIE. One of the critical measures yet to be employed is actual performance, on and response to, functional tasks and situations. For this study functional vocational tasks using electronic circuits and boards were designed with the intent of being sensitive to possible FIE effects. The tasks, involving error discrimination and accurate circuit board production, required many of the same cognitive skills that are remediated by FIE instruments. This thesis has attempted to address the need for ecological validity (Brooks and Baumesiter, 1977), the dearth of research evidence to date (Brandt, 1981; Chance, 1981) and in particular the effectiveness of FIE with students who have a mild developmental delay (Haywood and Arbitman-Smith, 1981). The results of this study have implications for the design of the next year of study, for future research in general and the increasing use of FIE.

Chapter II

SELECTIVE REVIEW OF THE LITERATURE

For the purposes of this study, which addresses the utilization of Feuerstein's Instrumental Enrichment Program (1980) with young adolescent students identified as being mildly developmentally delayed, a review of the relevant literature has been conducted. This review has been divided into three major sections: models of intelligence; causative theories of mild developmental delay; and models of cognitive - behavioral interventions. Each section provides an overview of the area indicated and its relationship to FIE.

Models of Intelligence

This section of the literature review will consider some of the major theories of intellectual development given the principle role of these constructs, both clinically and mediationally, in the study of developmental handicaps (Haywood and Wachs, 1981). A review of this area is confounded by a major consideration expressed most succinctly by Sarason and Doris (1979), who stated, "...the concept of intelligence has all the characteristics of an inkblot onto which people have projected meanings on the basis of which they wish to urge other people to see what they see,..."

The field is characterized by general disagreement as to the nature of intelligence and its development (Haywood and Wachs, 1981) and by general dissatisfaction with traditional views of intelligence and its measurement (Feuerstein, 1979; Budoff and Hamilton, 1976; Brown and French, 1979). Feuerstein's (1980) proposed theory of cognitive modifiability, explained at length later in this review, is a reflection of an increasing tendency to view intelligence and intelligent behavior as an improvable or trainable entity (Sternberg, 1981).

Psychometric

The psychometric model views intelligence as largely or exclusively innate, univariate, immutable and predictive (Gould, 1981; Feuerstein, 1979; Brody and Brody, 1976; Vernon, 1979; Burt, 1937). Initally intelligence was viewed as a singular, measureable entity that was exclusively a function of genetic endowment (Goddard, 1920 cited in Tuddenham, 1962). This theory of intelligence is generally no longer held. The current debate within the psychometric model is related to how much of the variance in intelligence can be accounted for by heredity recognizing that environmental factors do play a role in intellectual development. Generally this figure has ranged from 80% (Jensen, 1973; Hernstein, 1973) to 50% (Plomin and Defries, 1980). The concept of innateness is central to

those of immutability and predictability of future performance. Innateness implies a feature unchangeable through learning, therefore the greater the influence attributed to genetics the more fixed the result. A unilear concept that demonstrates adequate predictability requires a major static component.

A variety of hypothetical constructs of intelligence have been proposed in accordance with the psychometric model. Spearman (1904) developed a two-factor theory of intelligence in which there is a general 'g' intelligence, "the innate essence of intelligence" (Gould, 1981) and less important, the 's' intelligence factor indicative of individual abilities. This factorial model largely supported the univariate concept of intelligence. Cattell (1971) proposed a different type of two-factor model whereby there is a fluid (G) component reflective of biological capacity and a crystallized component (Gc) that is a function of learning. This is a more flexible model allowing for genetic influence, rather than simple genetic determination. Guilford (1967) proposed a mutli-faceted ability model of the intellect that negated an overall 'g' factor and included provision for a change in abilities. These later factorial models supported a less immutable and univariate construct then initially envisioned. The debate regarding 'g' remains unresolved. While both Vernon (1979) and Brody and Brody (1976) state that even though

discrepancies exist in factorial analysis, a general ability factor does appear. They draw, however, very different final conclusions with Brody and Brody (1976) reporting that intelligence may not be best understood by this factor as measured by psychometric tests. They further state that factorial analysis may be a rather poor method for understanding cognitive processes.

Feuerstein's (1979) main argument with the psychometric model is its static view of intelligence which for those who score low on a psychometric test has meant an unwarranted negative prognosis. Binet, the originator along with his colleagues, of one of the earliest "intelligence" tests (Binet & Simon, 1905) did not view his test as measuring intelligence but as a means to determine needed educational intervention (Sarason & Doris, 1979; Brody & Brody, 1976; Gould, 1981). This original intent, somewhat forgotten over time, is very similar to Feuerstein's (1979) view of the purpose of assessment.

Piagetian

Piaget's theory of intellectual development is briefly reviewed for three reasons: his phenomenal singular impact in the developmental field (Haywood and Wachs, 1981); the influence of Piaget's concepts in the development of FIE (Feuerstein, 1980); and, possible Piagetian instructional

and curricular approaches applicable to the subject group of this study (Bricker, Macke, Levin and Campbell, 1981). In Piaget's scheme intelligence is a mobile, nebulous concept actively constructed by the individual through his multi-faceted interface with his environment (Feuerstein, 1980; LeFrancois, 1972). This ongoing development of intelligent behavior is a function of a dynamic and complex developmental sequence and has been typified as antithetical to the psychometric model (Feuerstein, 1980).

Piaget postulated a universally invariant theory of development whereby the qualitative growth of cognitive ability could be operationally defined by specified stages. Movement through these developmental stages is a result of succeeding schemas (i.e., the operational unit which is a function of the assimilation-accommodation process) whereby cognitive complexity is constructed - schema built upon schema. In contrast to the psychometric model these inter-related schemas do not summate into a unitary entity (Haywood and Wachs, 1981).

Stephens (1977), based on the above concepts, has stated that a Piagetian curriculum would require the learner to be actively involved (e.g., manipulating materials, questioning and exploring) in the learning process. This conceptualization may be applied to the extreme where less than normally active learners are not given the directive assistance they require (Bricker et

al., 1981).

The developmental stage model has not yet been well integrated into special eduation (Stephens, 1977). For example, due to the critical period hypothesis, children with learning difficulties are not taught necessary skills because they do not manifest the presumed prerequisite schema. In other instances children are taught presumed prerequisite schemas that do not lead to advanced development or functional adaptation. An additional misapplication of Piaget occurs when the instructor fails to take into account the truly necessary prerequisite developmental abilities. Bricker et al. (1981) advocate the implementation of an integrated instructional-curricular approach that provides a balance between teaching prerequisites and teaching functional skills. These curricular and instructional issues are important to a critical analysis of FIE. While the learner is actively engaged in manipulating the FIE materials and asking questions with respect to the materials the question arises as to whether the FIE activities are a prerequisite to improved development.

A number of Piaget's constructs have influenced the development of FIE. In particular those that emphasize the dynamic approach to intellectual development through a modification of cognitive structure. The organism responds to environmental input and constructs new mental structures

of increasing complexity, moving from concrete abilities to operational abilities. This learning to reason is an important component of Feuerstein's model (Sternberg, 1981).

Information Processing

Sternberg (1979) notes that while there is an increasing interest in viewing intelligence as a function of dynamic information-processing capabilities, there is, as yet, no comprehensive information-processing theory of intelligence. The information-processing view of human abilities has produced another alternative to the more static conceptualizations and has sparked a fascinating array of intervention strategies for people who have a developmental delay (Sternberg, 1981; Butterfield, 1981).

In the field of developmental disabilities two major systems have been generally featured in describing information-processing models while concentrating on issues and interventions related to memory (Campione and Brown, 1978; Borkowski and Cavanaugh, 1979). In expanding from from theories applicable to memory and metamemory Campione and Brown (1978) have proposed a model of intelligence characterized by an architectual and an executive system. Borkowski and Konarski (1981) describe the architectual system, as a biological-genetically determined structure concerned with the perceptual coding and decoding of

information. They describe the executive system as being responsible for the expansion of the knowledge base, operation of long term memory and mediation of problems (i.e., control processes). While the precise development and operation of the model within an individual remains to be determined, Campione and Brown (1978) theorize that intelligent behavior is a factor of the efficiency and/or the quality of the executive functions. Support for this perspective is found in Sternberg's (1981) componential theory of intelligence. While he is slightly more willing to consider the role of immutable structural components (i.e., hardware) he does contend that structural defects could be offset by other processes.

While as a theory, information-processing componential models of intelligence are incomplete there is general agreement that intelligence can be taught (Campione and Brown, 1978; Borkowski and Cavanaugh, 1978; Borkowski and Konarski, 1981; Sternberg, 1981). This again, is athetical to the static models of intelligence. The above authors generally believe that the most appropriate means to train intelligent behavior is through the development of metacomponents, which Sternberg (1981) suggests FIE attempts to do.

Affective Aspects

Affective components, including intrinsic motivation,

have not been adequately incorporated into a theory of intelligence (Miechenbaum, 1980; Miller and Johnson-Laird, 1976; Haywood and Wachs, 1981). A discussion of the role of affect seems appropriate given the role of intrinsic motivation in FIE (Feuerstein, 1980). While Piaget (1962) had argued that affect should be seen as an integral part of cognitive development, Zajonc (1981) has accused current cognitive psychology of basically ignoring affect.

They suggest one may be motivated to seek information, responsibility and challenge, or to avoid such cognitive building activities (Haywood and Burke, 1977). Haywood and Wachs (1981; Haywood, 1968) further state that individuals who have a developmental delay are more extrinsically motivated than non-handicapped individuals and this can reduce performance and learning. Zigler and Balla (1981) support the importance of motivational variables in cognitive development and state that individuals with a mild developmental delay are characterized by interfering or ineffectual motivational characteristics. In their review of the literature they found these variables not to be inherent to "mental retardation" but a result of deprivation and a history of failure. Miechenbaum and Butler (1981) suggest, based on a review of a number of studies, that negative self-ideation is associated with poorer performance intellectually. They note that at this point in time it is not possible to determine a cause and

effect relationship. The assumption is, as supported by the motivational studies mentioned above, that individuals with a mild developmental delay have negative self-referent perceptions which is reflected through their lowered intellectual performance. Feuerstein (1980) has attempted to account for the issue of motivation by utilizing tasks that arouse curiosity and a need to succeed coupled with the "partnership relationship" of the teacher.

Social-Cognitive

Feuerstein's and his associates (Feurstein et al., 1981, Feurstein, Rand, Hoffman, Hoffman and Miller, 1979, Feurestein, 1980) model of cognitive modifiability is considered, for the purposes of this study as a separate and distinct model. Sternberg (1981) has included Feuerstein's model within his componential approach to mental abilities due to its focus on metacomponents. Feuerstein (1979) defines intelligence as: "the capacity of an individual to use previously acquired experiences to adjust to a new situation". Inherent in this definition is the concept of the modifiability of intelligence given appropriate training strategies. In contrast to the static and immutable product view of intelligence, Feuerstein (1979) supports an active process that is open to change and development. In addition to the concept of modifiability, the other critical feature in Feuerstein's

(1980) model of intelligence, is the mediated learning experience. These experiences are the means by which modifiability occurs.

The transmission of "the culture" from one generation to the next is fundamental to Feuerstein's (1980) model of adequate intellectual development. Feuerstein (1979) is not referring to the simple cataloging of cultural dimensions but to the actual process by which it is transmitted. While the importance of culture to development has often been recognized (Ramey and Finkelstein, 1981; Baroff, 1974) and has included the concept of culturally different modes of information processing (Das, 1973) the research emphasis has not been on the transmission process but on the cultural situation itself (e.g., poverty). In Feuerstein's (1980) model cultural transmission is primarily accomplished through the mediation of a primary adult care giver. Feuerstein (1980) states that the human mediational factor accounts for the individual variation in development that Piaget's model does not account for.

In Piaget's model, learning and development, is a result of the direct interaction between child and the environment, the nature of the interaction being entirely interpreted by the child's cognitive structure. A possible conclusion is that a significantly large proportion of responsibility for intellectual development is the child's.

Feuerstein's (1980) model places a large proportion of the responsibility for cognitive development upon the care giver. The role of the care giver in development has been considered by a number of authors in areas such as adequacy of care giving (Clarke and Clarke, 1976; Bradley and Caldwell, 1976; Heber, 1978); language interactions (Nelson, 1973; Schoggen and Schoggen, 1976); parental expectations (Das, 1973); and parental anxiety (Sarason, 1975). Feuerstein (1980) suggests an additional role for the care giver as a cognitive mediator.

Feuerstein (1980) states that the mediated learning experience is the universal critical variable in the development of adequate intelligence. The care giver provides mediated learning experiences (MLE) by "selecting, framing, grouping and establishing temporal, spatial and casual relationships between stimuli thereby regulating and orienting the child's behavior and development (Feuerstein, 1980). The process of mediating being far more important than the content or modality of the transmission.

An MLE is defined by the following criteria all of which must be met in order to consider an interaction as mediating (Feuerstein and Hoffman, 1982):

Intentionality - the mediator must have an implicit intent to mediate and the intention must be shared with the child;

Transendence - mediating events of the "here-and-now"

to situations that are remote in time and space;

Meaning - affective, motivational and value-oriented meanings must be attached to the stimulus.

Two additional criteria are functions of specific experiences:

Competence - child must be made to feel able and/or;

Regulation of behavior - promotion of efficient cognitive strategies.

In summary, it is the provision of mediated learning experiences by a primary care giver that determines the intellectual development of the child. Given the concept of cognitive modifiability inadequacies of intellectual development which are due to the failure to provide for "cultural transmission" can be offset in later years by appropriate training strategies.

Causative Models of Mild Developmental Delay

This section of the review will consider the predominant causative models of mild develomental delay. There is not necessarily a direct relationship between the content areas of each major section of this review as a model of cognitive development may not have a well defined causative hypothesis that explains limited development or a well defined methodology for intervention.

Genetic

It follows logically from the psychometric model that

the causative factor of a perceived limited ability to learn is an inferred limited genetic disposition. The major evidence for this model comes from psychometric studies which demonstrate significant correlations of I.Q. between parent and offspring or I.Q. variations between one race and another (Vernon, 1979; Brody and Brody, 1976). Both Vernon (1979) and Feuerstein (1979) describe an 'anti-test' movement which has arisen due to the lack of agreement in the field as to what precisely I.Q. tests measure and what those measures therefore mean. Also the possibility of bias towards white middle class values has been considered as a reason for low scores among members of differing socio-economic status or racial groupings (Dunn, 1973, Birch and Gusson, 1970; Sarason & Doris, 1979).

This causative model, because of the concepts of innateness and immutability, has resulted in the advocacy of extremely negative social control practices (Wolfensberger, 1972; Begab, 1975; Lazerson, 1975). The primary and almost exclusive means of defining a developmental delay remains I.Q. (Adams, 1973). Feuerstein (1980) typifies this model as "passive acceptance" given the immutable perception of intelligence. Essentially if intelligence is fixed and unchangeable, active remediation and intervention is negated. The genetic model which contends that scores can be attributed solely to heredity is contrasted by other models which incorporate

environmental components to varying degrees in explaining I.Q. results (Vernon, 1979; Sarason and Doris, 1979).

In summary, the inferred genetic deficiency model has no demonstrated positive utility and remains unprovable.

Environmental

This approach holds that the development of intelligence is totally a function of the environment except when there is some known physical defect. This model is closely aligned with the radical behaviorist position which views intelligent behavior as a function of learned operants (Feuerstein, 1980). The essence of this model is that a developmental handicap is a result of a non-supportive environment (e.g., poverty, or poor parenting) and that rectifying this environment can restore or greatly assist normative cognitive development. Intelligence is perceived as something that can be learned and therefore taught. Much of the support for the environmental position comes from studies demonstrating successful intellectual development after experiencing early deprivation (Skeels, 1966; Clarke and Clarke, 1976). Also from studies demonstrating changes in I.Q. over time and/or as a result of instruction. The question of I.Q. performance changes as a result of learning is more controversial. Vernon (1979) states that I.Q. is not changed through early intervention while Garber and Heber

(1981) concluded differently.

While a strict environmental model tends to negate individual differences it has a major advantage over the psychometric in its inherent support of intervention and improvement (Feuerstein, 1980). It appears impossible at this time to separate genetic from environmental impact and it has been suggested that the effort to support one extremist position over another is overly simplistic and not particularly useful.

Interactional

This is a more highly accepted model of intellectual development where intelligence is seen as a product of a genetic-environmental interaction (Ramey and Finklestein, 1981). While this model is considered to have the capacity for a causative explanation of development disability, the field has generally failed to explain or determine how the two variables interact to produce intelligence or intellectual delay (Ramey and Finkelstein, 1981). Instead there has been a debate on the proportional variance of one variable over the other in accounting for intelligence as measured by I.Q. tests. As both Birch and Gussow (1970) and Gould (1981) have advocated it is time to stop using correlational statistics as evidence of cause.

One possible hypothesis to account for the interaction

of heredity and environment is the threshhold concept (Das, 1973). This hypothesis proposes that an individual with a specific genetic make-up requires a particular level of adequate environmental stimulation in order to develop normatively. Failure to provide the needed level would result in "retarded" development.

The future emphasis for this model must be placed on determining which methods in which contexts are needed to ensure as adequate a development as possible (Ramey and Finkelstein, 1981). No clear mechanism for the interaction of heredity and environment yet exists. Feuerstein's (1980) model of limited cognitive modifiability due to a lack of mediated learning experiences, which is explained shortly, is largely based on an interactional model.

Transactional

This model (Figure 1) has been primarily developed by Sameroff and Chandler (1975) and is an extension of the interactional model. What is central to this model is the continuous changing relationships over time between the individual and the environment, each as well changing/developing over time, with a certain portion of the change being due to the continuous interaction itself (Schoggen and Schoggen, 1981). This model accounts for a much more dynamic interplay of forces than the interactional model which does not allow for the individual affecting the

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Figure 1: Transactional Model of Retarded Development.

Sameroff, A. J. & Chandler, M. J. (1975). Reproductive risks and the continuum of caretaking casualty. In F. D. Horowitz, M. Hetherington, S. Scarr-Salapatek, and G. Siegel (Eds.), Review of Child Development Research (pp. 187-244). Chicago: University of Chicago Press.

environment or differing effects over time. Sarason and Doris (1981) support this model as it suggests a developmental handicap occurs in a social context and does not reside completely within the individual. The developmental handicap may be the result of an inadequate environment at a particular moment in time given the development of the individual at or until that moment in time. The individual him or herself affects the adequacy of the environment to support normative development. Partial support for this model comes from studies such as those by Moss and Robson, (1968), Denenberg and Thoman (1976), Yorrow, Scott and Waxler (1973), and Zeskind and Ramey (1978) which demonstrates that the child's behavior influences the parent's behavior and vice versa.

While this model needs more detailed development as well as supporting research it does hold a fair amount of promise. It suggests a casual relationship that is dynamic and complex and that allows for individual differences. More importantly it suggests that remediation and intervention be constructed and applied in a more total conceptualization or possibly even holistic conceptualization than the other models. Intervention must focus on the social context not simply on the individual in isolation from his/her world.

Information-Processing

Within this framework a number of possible causative

mechanisms have been suggested as means of explaining the performance of individuals with a developmental delay. Using Campione and Brown's (1978) model, a structural defect would entail a deficit in the "hardware" components of the architectual system. Simplistically put, the parts may be incomplete, missing or broken. For example, the system may not have sufficient memory capacity as a structurally complete or correct system would. Some confusion exists in that a structural defect could also refer to the manner in which the hardware components are linked (Campione and Brown, 1978). Fisher and Zeaman (1973) have supported the concept of a structural deficiency as an explanation of developmental delay.

A mediational deficiency is defined as occurring when an individual fails to use a specific mediational strategy (i.e., rehearsal) even when instructed to do so. A production deficiency is said to occur when an individual fails to use a mediational strategy that is within their repetoire (Flavell, 1970). The former is possibly indicative of not being able to learn and the later of the inability to respond appropriately with strategies that had already been learned.

Campione and Brown (1978) propose a control process deficiency to account for the failure of trained strategies to generalize. This concept states that individuals with a developmental delay lack adequate executive processes

(e.g., metamemory) to enable their information-processing system to work effectively. They lack knowledge about how to form a plan to plan, how to know how to learn and how and when to use the mediational strategies they do have.

The first type of possible deficiency has been criticized on two grounds: 1) it is a self-defeating hypothesis in that structural components are viewed as immutable, defects are therefore not correctable (Sternberg, 1981; Campione and Brown, 1977); 2) proof of the deficiency is based on circular reasoning. Failure to evidence use of a taught strategy is viewed as evidence of a structural deficit when the failure may be the result of inadequate or inappropriate instruction (Borkowksi and Cavanaugh, 1979). In addition Fisher and Zeaman (1973) cite the stability of I.Q. as partial proof of their model yet the disagreements over I.Q. remain serious and present. As Sternberg (1981) states, the distinction between structure and process is probably unnecessary and untenable at this time.

The other deficiency concepts hold more promise as they allow for intervention and learning. Both the mediational/production and control processing deficiency theories have led to intervention strategies which have applicability in the classroom (Kramer, Nagle and Engle, 1980).

Cultural Deprivation

It is important to recognize that Feuerstein (1979, 1980) uses the term cultural deprivation to refer to a lack of mediated learning experiences. Feuerstein's use of the concept differs dramatically from the traditional use of the term. In Feuerstein's (1980) model the lack of MLE (defined earlier) is suggested as a universal proximal cause of low academic and I.Q. test performance. Distal etiological factors that result in low performance include endogenous conditions of the child, parental conduct, and poverty. In Feuerstein's (1980) model these distal factors may certainly interfere with the care giver's ability or opportunity to provide MLE or the child's ability to benefit but they in and of themselves are not responsible for cognitive deficits. This construct permits the model to account for individual differences as well as a greater preponderous of cognitively deficient individuals from low socio-economic or differing cultural groups. Lack of MLE results in a reduced state of cognitive modifiability which in turn inhibits cognitive development.

The result of the lack of MLE is "retarded performance" which can be described by a number of deficient cognitive functions. These deficient functions can be assessed and a remediation plan developed and implemented. The primary purpose of FIE is to remediate the said cognitive deficiencies (Table 1). Feuerstein

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Table 1: Cognitive Deficiencies

Feuerstein, R. in collaboration with Rand, Y., Hoffman, M. B., & Miller, R. (1980). Instrumental Enrichment: An Intervention Program for Cognitive Modifiability. Baltimore: University Park Press.

(1980) makes the following points regarding these deficiencies:

1. The deficient cognitive functions are determined by administering Feuerstein's (1979) Learning Potential Assessment Device (LPAD) which indicates their amenabiliity to change.

2. The list of deficient functions is neither exhaustive nor mutually exclusive.

3. The combination of deficiencies varies with the individual as does the extent of the expression of any one of the deficiencies that are present.

4. The individual's cognitive functions are generally perceived as deficient not as absent. Appropriate cognitive functions are weak, do not occur spontaneously, regularly or predictably.

5. The deficient functions are categorized by which of the three stages of the mental act - input, elaboration, and output - they occur in (Feuerstein, 1980). These three phases must be considered in relationship to each other.

In his position on "retarded performance" and its etiology, Feuerstein (1980) does not distinguish between those with a learning disability, an emotional disturbance or a mild developmental delay. The proximal cause remains the same as does the principle means of intervention. From a different conceptual basis Neisworth and Greer (1975) and Hallahan and Kaufman (1977) adopt a similar hypothesis that

there is little functional utility in differentiating between the three groups as they benefit from similar instructional processes.

Philosophically Feuerstein's (1980) model is very positive as it has a highly optimistic outlook towards improvement given appropriate intervention. Cognitive modifiability, as a concept of dynamic intellectual development is a refutation of the static view of intelligence and intelligent behavior. The more specific aspects of the causative model, however, are largely theory at this time. Research evidence on the lack of MLE as a proximal cause of a broad range of learning difficulties is simply not available. There is some indirect support, as noted earlier, in that parental and environmental factors have been shown to impact on development and that initial negative effects may be overcome. Other than as a result of his own assessment device (Feuerstein, 1979), offers no empirical support for the cognitive deficiencies he states characterize the "retarded performer". One additional point is that universal causative theories tend to have an inherent flaw in that it takes only one exception to disprove the universality. A more plausible and useful theory might be one that states the lack of cognitively mediating experiences in combination with different environmental conditions at differing times of development may affect intellectual ability to varying degrees for

different individuals. This proposed causative model while substantially more complex is consistent with a transactional approach to development.

Intervention Strategies

This portion of the review will be restricted to a discussion of interventions that bear a relationship to FIE and of course FIE itself. There has been an increasing interest in the development and promotion of strategies and programs designed to teach intellectual skills (Sternberg, 1981). These efforts, particularly with respect to persons with a developmental delay have occured as a result of a number of differing factors.

These factors have included the failure of traditional training methods to demonstrate generalization (Miechenbaum, 1980) and a shift from a psychometric model of intelligence to an information-processing model with corresponding emphasis on metacognitive components (Sternberg, 1979; Flavell, 1978). This dissatisfaction with the static attributes of the psychometric model, also influenced Feuerstein (1980) who viewed the individual, except in extreme circumstances, as capable of developing intelligent thought processes even in adolescence.

Assessment

The dissatisfaction with an immutable and

static concept of intelligence has also influenced the development of assessment procedures. The procedures themselves vary but the intent is similar, to understand the procesess at work and to determine the potential of the individual. Miechenbaum (1980) proposes cognitive-behavioral assessments that determine the individual's thinking processes, which is the intent of Feuerstein's (1979) LPAD. A number of authors, other than Feuerstein, have noted the need to develop measures of potential by testing procedures that include instructional processes. Budoff (1975) has developed a procedure based on the Kohs Block Design (1923) and Raven's Progressive Matrices (1956) to determine learning potential. These procedures were initially developed to distinguish those with a "true" educational handicap ("a non-gainer") from those whose disability was probably related to a lack of appropriate learning experiences ("a gainer"). Subjects are tested on a non-verbal problem, then receive instruction when difficulties arise and are then tested again to see if learning has occurred. Brown and French (1979) have proposed a method to assess potential derived from Vygotsky's theories. In this format a child is asked to complete a test item independently, when the child fails on an item, information is gradually added until the child succeeds. The level of competence reached with assistance is the subject's zone of potential development. The less

assistance needed the wider the zone. Feuerstein's (1979) approach is similar. The subject is given a test item presented in one or more modalities (e.g., numerical, figural, or verbal) and the necessary corrective assistance if the subject fails the test item. Once mastery is achieved, progressively more difficult tasks are presented. These results provide information as to the type of cognitive deficiencies present and the strategies and effort needed to overcome them.

Generalization

Campione and Brown (1977, 1978) state that the ability to generalize information and strategies across situations is one of the hallmarks of intelligence. Evidence of generalization must be seen as one of the key criteria in assessing the success of any training program (Kramer, et al., 1980; Stokes and Baer, 1977). Consistent with this view is the proposition that the true purpose of schooling is essentially success in out-of-school tasks and situations. That the learning that takes place in school must generalize to natural environments outside of school (Brown, Branston, Hamre-Nietupski, Pumpian, Certo and Gruenewalk, 1979).

There has been some confusion in the literature regarding the distinction between strategy maintenance and strategy generalization (Campione and Brown, 1977). Borkowski and Cavanaugh (1979) define maintenance or

durability as "the continued use of an acquired strategy on a task identical to that used during training", while generality to be demonstrated, requires not only a test with new materials but a change in task demands as well. The concept of generalization can be further refined when placed along a linear dimension proceeding from near to far. Near generalization constitutes a minimal change in task demands and is closest to strategy maintenance. Far generalization is demonstrated when the task demands are substantially different than the training task. Demonstration of far generalization is the more desired goal indicating a greater breadth to the strategy that has been learned (Borkowski and Cavanaugh, 1979; Kramer, et al., 1980). The purpose of this study is to determine if far generalization is demonstrated on an out-of-school task.

There seems to be a concensus not only on the necessity to establish generalization but also in the direction that training should proceed in order to accomplish this goal. To date there has not been much success in establishing generalization (Campione and Brown, 1977; Borkowski and Cavanaugh, 1979; Kramer, et al., 1980). These authors suggest future training efforts should be directed at teaching metacognitive skills which would, hopefully, result in the employment of relevant strategies in the presence of new tasks. Teaching how to learn without instruction, focusing on learning how to learn

rather learning specific content. Content learning would not be replaced but added to by training efforts to teach thinking skills.

Cognitive Behavior Modification

Miechenbaum (1980) and Miechenbaum and Asarnow (1979) have noted many similarities between the suggestions for metacognitive training by Brown (1978; Brown, Campione and Murphy, 1977) and cognitive behavior modification (CBM). Commonly accepted metacognitive processes include checking, planning, asking questions, self-testing and monitoring (Mienchenbaum and Asarnow, 1979).

In a review of self-management training, Dennis and Mueller (1983) conclude that these strategies have demonstrated utility with those that have a developmental delay althought concerns about generalization remain. A conclusion supported by Litrownik, Freitas and Franzini (1978). For example, Horner and Brigham (1979) were able to teach two young adolescents with a "borderline" developmental delay to successfully monitor their own on task behavior during independent study times. However, there were no generalization tests and the self-monitoring effects appeared to be short lived. A similar approach has been taken by Schumaker, Deshler, Nolan, Clark, Alley and Warner (1981) based on the Learning Strategies Model of Alley and Deshler (1979) and applied to adolescents with a learning disability. The learning strategies approach

teaches thinking skills, one of which includes error monitoring. Error monitoring requires students to continuously appraise their own work in order to reduce error production and to notice and correct errors that are produced. Instrumental enrichment is concerned with teaching students to plan so as to reduce errors and to increase spontaneous corrections of errors (Feuerstein, 1980).

The purpose of self-instructional training is to teach some of the skills that constitute the metacognitive processes that govern intelligent functioning. The intent is not to provide a simple set of verbal behaviors suited to a particular task but rather knowledge or metastrategies that will guide the person regardless of the task. Self-instructional training has been used with those who have a developmental delay to reduce impulsivity (Peters and Davies, 1981), control distractability (Burgio, Whitman and Johnson, 1980) and teach academic skills (Miechenbaum and Asarnow, 1979; Leon and Pepe, 1983).

Among the many goals of FIE are a reduction of impulsivity and an increase in planned behavior, both specific goals of self-instructional training with some evidence of successful applicability to the population under study. Another interesting similarity is Feuerstein's (1980) repeated reference to students' statements describing their problem solving strategies as

indicative of the effectiveness of FIE or in other instances as examples of students' not yet well developed enough cognitive prowness.

Some caution should be noted in that a number of reviews, (Hobbs, Moguin, Tyroler and Lahey, 1980; Pressley, 1979; Dennis and Mueller, 1983) question the durability and generalization effects of self-instructional training. While Burgio et al. (1980) included efforts to measure utilization of learned self-instructional statements there is a fair amount of concern expressed in the literature as to how to measure covert behaviors, particularly as they are claimed to influence behavioral outcomes as a result of training (Hobbs et al., 1980).

In total there are still very few studies demonstrating the use of CBM techniques with subjects that have a mild developmental delay. Receptive language difficulties can inhibit, in all liklihood, the potential effectiveness of self-instruction (Uditsky, 1983). From an educational perspective its applicability is limited, unlike FIE, by the absence of a succinct curriculum or process that teachers can readily integrate into special education settings.

Training of Metamemory Skills

A review of this area is included as metamemory is perceived as a component of intelligence in the

information-processing model (Sternberg, 1981). Metamemory training may provide support for the training of other thinking skills. Metamemory refers to awareness or knowledge of one's own memory system and how it works (Flavell and Wellman, 1977). Some possible metamemory components include recall, readiness, study-time apportionment and span estimation (Borkowski and Cavanaugh, 1979). It has been well demonstrated that children with a mild developmental delay can be taught a variety of strategies (e.g., rehearsal and interrogatives) and to maintain them with occassional generalization (Borkowski and Cavanaugh, 1979). In a review of the literature, Borkowski and Cavanaugh (1979) report on only six studies that demonstrated strategy generalization as the result of "in-depth, prolonged and often with feedback about the strategy's purpose" training efforts. The difficulty of achieving generalization of specific mnenonic strategies has led to an increased interest in the training of metamnemonic skills (Kramer et al, 1980; Brown, Campione and Murphy, 1977).

Most of the research in this area has been conducted by Ann Brown and her colleagues (Brown, 1978; Brown and Barclay, 1976; Brown and Campione, 1977). Brown (1979) was able to train children with a mild developmental delay (MA 8 years) to use a recall readiness strategy when asked to remember a "supra-span" list of pictures. One year later

the children not only maintained the taught strategy but also generalized the strategy to facilitate gist recall of prose passages (i.e., far generalization). This study's results are consistent with Brown and her colleagues (Brown and Barclay, 1976; Brown, 1977; Brown & Campione, 1977) position that there is a correlation between mental development and ability to use metamnemonic strategies. Kendall, Borkowksi and Cavanaugh (1980) in a study with approximately 30 children with a mild developmental delay concluded that metamemorial knowledge, as measured by subjects' verbalizations, not only predicted success of an interrogative strategy but functioned as a prerequisite to success. The most promising direction appears to be in a combination of efforts devoted to specific strategy and metamemorial strategy training (Campione and Brown, 1977; Kramer et al, 1980; Borkowski and Cavanaugh, 1979). Feuerstein (1979) also states that a combination of training of performance and metacognitive components provides the greatest likelihood of successful intervention. Metamemorial strategies can be considered as part of the "production of insight" goal of FIE which includes decisions on which strategies to use in new situations in order to achieve a successful outcome.

Unfortunately, while strategy training and development of metacognitive skills appears to hold much promise there is as yet no specific curriculum or general teaching

methods well enough defined for teachers to employ. Borkowski and Cavanaugh (1979) state that future efforts to teach generalizable skills both at the executive and specific strategy levels will require a combined methodology that includes direct instruction and task analysis, knowledge from information-processing models, and cognitive behavior modification. They state these elements must be synthesized to identify several strategies applicable to different situations, to train these strategies and where and when to use them, to train for generalization, to teach self-generated problem solving strategies, to build on the child's strengths and to explicitly reinforce executive functioning when it occurs in the natural environment. This approach, while still largely underdeveloped, is remarkably similar to the efforts being directed at teaching generalization to those with even more severe learning difficulties. These include ecological and social validation procedures to determine what skills are required in natural environments, training in natural environments to natural occurring cues and reinforcing generalization when and where it occurs (Brown, Branston, Hamre-Nietupski, Pumpian, Certo and Gruenewald, 1979; Snell, 1983).

Feuerstein's Instrumental Enrichment

Feurstein (1980) has defined FIE, "as a direct and

focused attack on those intellectual functions diagnostically determined as being responsible, because of their weakness or nonexistence, for poor intellectual performance". The major goal of FIE being, "to increase the capacity of the human organism to become modified through direct exposure to stimuli and experiences provided by the encounters with life events and with formal and informal learning opportunities" (Feuerstein, 1980). See Appendix A, Characteristics of the Feuerstein Instrumental Program (Feuerstein, 1980) for an overview of the program's various aspects.

This major goal is further divided into six sub-goals summarized below (Feuerstein, 1980):

1) Correction of deficient cognitive functions so as to improve congitive structures, attitude and motivation of the "culturally deprived" learner.

2) Acquisition of basic concepts, labels, vocabulary, operations, and relationships used in FIE so as to allow the individual to benefit from the program.

3) Establishment of intrinsic motivation is considered to be one of the more vital sub-goals. This ensures that the learner continues to use higher mental processes and to benefit from them even if the learner remains in a non-supportive environment.

4) Production of reflective, insightful processes that help to inhibit inappropriate responses and support

organized, articulated and differentiated responses.

5) Creation of task-intrinsic motivation by learning to enjoy a task for its own sake and for the social meaning of success.

6) Establishment of a "self-perception" that results in the learner seeing himself as an active generator of new information. Another one of the more critical sub-goals whereby the learner no longer perceives himself as simply a passive recipient and reproducer of information.

The FIE materials consist of 15 paper and pencil "instruments" comprising over 500 pages of essentially content free and non-curricular bound material. The intent of the materials is to establish an adequate cognitive structure through their utilization. "The material is not an end in itself" (Feuerstein, 1980), hence the content free emphasis. Feuerstein offers other reasons for the content free construction all of which are based on reducing the resistance of the learner and of the teacher to the materials and to overcome resistance which has developed as a result of previous failures with content bound curriculua.

Twelve of the fifteen instruments are divided into units and are graded along a continuum from easier to more difficult. Each instrument not only focuses on a particular cognitive function but also addresses less directly, a multiplicity of cognitive deficiencies.

Instruments can also be divided into those that require no literacy, (e.g., Organization of dots, Analytical Perception, and Illustrations), some literacy with teacher assistance, if necessary (e.g., Orientation in Space I, II and III, Comparisons, Family Relations, Numerical Progressions and Syllogisms), and those requiring independent reading and comprehension skills (e.g., Analogies).

Typically lessons are taught in one hour blocks, three to five days per week over a period of two to three years by teachers trained through FIE approved workshops. Instruments may be taught in any sequence deemed appropriate to the needs and characteristics of the individual or the class. While there is no set system some instruments must be taught in a particular sequence (e.g., Orientation in space I prior to Orientation in space III) particularly nonverbal prior to more verbal ones when used with students with limited literacy. While specific instruments may be used according to individual results on the LPAD, the common practice is to use all the instruments with or without LPAD results. Feuerstein (1979, 1980) offers no examples of how specific instruments may be used for determined cognitive deficiencies as identified by the LPAD. Support for applying FIE across the border comes from the rationale that no student will suffer cognitively from doing unneeded instruments and may actually benefit

from the practice and/or success. Two different instruments are taught concurrently, in alternate lessons, to reduce possible sources of frustration or boredom. Each of the instruments at the end of the units contains exercises for assessing mastery. Feuerstein et al (1981) recommends the hetergeneous grouping of culturally deprived learners with able learners. This, he suggests, reduces stigmatization and enhances learning opportunities.

Research

Most of the supportive research stems from one initial study (Feuerstein, 1980; Feuerstein et al., 1979) after the completion of an FIE program and one follow-up study on the same group of subjects two years later. (Feuerstein, 1980; Rand, et al., 1981). The study was conducted on a group of Sephardim Jewish children most of whose families had emigrated to Israel prior to 1967. The study began in 1971 (Feuerstein, 1980) when most of the children had spent their early years and elementary education in Israel. Feuerstein et al. (1979) reported that the families of the students were found to be disadvantaged on every socioeconomic factor measured utilized: income, literacy, years of schooling, housing density, family size, and occupational status. The original study was conducted on 218 subjects, between the ages of 12 - 15 years, (M=13.64), two-thirds of whom were males. All were attending either

residential centres or day centres operated by the Youth Aliyah Program. The residential setting, according to Feuerstein (1980), provided a much healthier environment than the home environment, with a program based on an "active modification" approach. The day centers provided a "typical" vocational oriented program with the child staying in his home environment. Feuerstein (1980) refers to it as having a "passive-acceptant" approach to the child's ability and potential.

Subjects were recruited from two residential centers and two vocational schools (day centres). They were grouped into experimental (FIE) and control groups (GE). Results were reported for the two groups as whole and for 57 matched pairs which had no significant pretest differences. Significant posttest differences were the same for both the matched pairs and the overall groups. All subjects were pretested on the Thurstone Primary Mental Abilities Test (PMA) version 4-6 (1965). Subjects were found to be in the borderline and mild developmental delay categories with a total mean I.Q. = 80 (Feuerstein, 1980). Subjects were tested for achievement on the Project Achivement Battery which was developed by the study's research team to assess the impact of FIE on curriculum content areas (Feuerstein et al., 1979). Subjects were also tested on the Tannebaum and Levine (1968) Classroom Participation Scale (CPS) which is divided into a checklist

of traits (CPS I) and appropriate and inappropriate behavior descriptions (CPS II) and the Levine and Katz (1971) Levidal Self-concept Scale. Actual pretest scores by treatment and control groups are not reported.

All teachers providing FIE had completed approved training and two new teachers were trained in the second year due to staff changes. Teachers were supervised weekly in class during the first year of the study receiving feedback on their performance. Teachers were also observed teaching non-FIE subject matter. Supervisors observed the FIE class being taught regular subjects all of which was done to determine if observed student-teacher interations were a phenomenon unique to FIE. No information on observation methods or results were reported. Teachers of the regular Youth Aliyah curriculum [called General Enrichment (GE)], received the ususal inservices provided to Youth Aliyah teachers by that organization. Three of the GE teachers had previously been trained in FIE. Their utilization was unavoidable as part of the research agreement not to exclude any regular homeroom teachers.

All experimental classes received the FIE materials in sets of 3 and followed a particular sequence, with Organization of Dots, Orientation in Space I and Comparisons as the first set. At the end of the first year, all experimental classes had completed at least five of the instruments but not necessarily the same ones and at

the end of the second year "the majority had completed most of the instruments" (Feuerstein, 1980). Students were regrouped at the beginning of the second year due to vocational interests or academic achievement. As such students from non-FIE moved into FIE classes and vice versa, naturally the number of such student changes influenced the choice and pace of the instruments. These undesirable artifacts were not under the control of the research team.

In addition to the pretests noted above seven additional tests were given as posttests. These were the Witkin's Embedded Figures Test (EFT) (Witkin, 1950); Human Figure Drawing Test (HFT) (Witkin, Dyk, Faterson, Goodenough and Karp, 1962); Kuhlmann-Finch postures test (KFT) (Finch, 1953); and Lahy Test (Zazzo, 1964), all intended to measure specific cognitive functions. Three nonverbal intellective measures were Porteus Maze Test (Porteus, 1964); D-48 (Gough and Domino, 1963); and Terman Test (Terman, 1942). The original hypothesis was that the residential settings would have a greater positive effect in combination with FIE than the day settings would. This hypothesis was not supported and the results reported herein on the effects of FIE versus GE refer only to the significant findings that are most applicable to the study at hand.

On four of the eight PMA subtests and the total

score, FIE subjects did significantly better posttest. There were no significant difference on the remaining four subtests. The FIE group scored significantly better on two of the 12 subtests of the achievement tests. On the pretest the GE group had scored significantly higher on four subtests but this effect was eliminated by the posttest. The FIE group also received about 300 hours less of the regular curriculum. Signficant differences for the FIE groups were demonstrated on the Terman and the D-48 with no significant differences on the Porteus I.Q. test. Significant results for FIE were found on all tests measuring specific cognitive functions except one (Lahey total number) on which no differences were found. Significant results for FIE also occurred on the CPS II measures with no difference on the CPS I measures.

In summarizing Feuerstein (1980) concluded that FIE enhances the cognitive development of "retarded performers" while generalization to content areas was not clearly demonstrated, FIE is suggested as a possible means of providing the necessary cognitive structures to ensure that content learning does occur.

The divergent effects hypothesis of FIE states that the expected improvement from FIE should be cummulative as it provides the cognitive structures necessary to support future learning. Two years after completing the FIE program many of the older subjects were drafted into the

Israeli army. Results from the army enlistment are reported in Feuerstein (1980), Feuerstein et al., (1981), Feuerstein et al., (1978) and Rand et al., (1981). Four army tests were used, the Dapar, an intelligence test; a Hebrew vocabulary and language skills test; the Zadakh, an interview prediction rating on future army success; and the Kala, a composite measure of the above tests. Rand et al., (1981) reported that the FIE group, two years after the FIE program, recorded slightly higher I.Q. scores than the general army average while the GE group recorded significantly lower scores than the FIE group. Results after one year of FIE are reported in the follow-up study as these students started the program at the end of their schooling. While doing significantly worse on the Dapar than the two year FIE group, they did significantly better than the one year GE and as well as the two year GE. The GE group performed significantly better than the FIE group on the language test. No significant differences were found between FIE and GE effects on the remaining measures. Support for sustained long term effects are suggested as 12% of the FIE subjects who scored high on the pretest PMA scored low on the Dapar, while 88% scored high. By contrast 47% of the GE subjects who scored high on the pretest scored low on the Dapar. In the same vein 46% of FIE subjects scoring low on the pretest scored high on the posttest while only 13% of the GE subjects did so. The

results support, according to the authors, the maintenance of FIE gains over time and the divergent effect hypothesis. More importantly the FIE group scored on the intellective test within the range of normality thereby possibly opening up significant social and vocational opportunities (i.e., officer training school).

Haywood and Arbitman-Smith (1981) report on the results of a one year pilot study and in a separate study on the first year of a two year intervention program using FIE. Students in both studies were chosen predominatly from low socio-economic status (SES) groups. The pilot study students were 60% black and the students in the two year study were almost all from Mexican-American immigrant farm worker families. All subjects were divided into four categories (i.e., EMR, LD, VE = varying exceptionalities, and BD = behavior disordered). School achievement effects were not expected in the first year of either study and none were found. The pilot group received approximately 58 hours of FIE. All pilot categories of students showed raw score gains in I.Q. pre to post with a significant gain across all categories combined. Significant or non-significant gains for individual categories are not reported. In comparison to the control group in the pilot study, across all categories there was a significant greater gain in mean I.Q. for FIE students. On the letter series of the PMA, the group with a mild developmental

delay (EMR) dropped in score while all other categories of subjects improved. This test was selected for isolated analysis because it was felt to require the analytical and analogical problem solving strategies believed to be deficient in the subject population. A significant favourable difference was found when results were compared across all categories.

In the other study, being one year of a two year program, subjects received 93 hours of FIE on average. The data from this group is not as encouraging as that from the pilot study. There were no significant gains in I.Q. scores. The control students with a mild developmental delay significantly declined in self-concept scores in comparison to the experimental students in the same category who remained the same. This is interpreted as possibly meaning that FIE sustains self-concept in a situation, the segregated special education class, in which self-esteem has been suggested as descreasing over time (Haywood & Arbitman-Smith, 1981). There were significant gains for students with a mild develomental delay receiving FIE on the General Information subtest of the Peabody Individual Achievement Test (PIAT). In one sample group of these subjects from the city of Phoenix there were significant gains in non-verbal IQ for the experimental group when compared to control students who were not tutored. Other sample differences are not reported.

On the basis of these results, Haywood and Arbitman-Smith (1981) conclude that modest and less than modest gains may be achieved on standardized measures of intelligence and cognitive abilities using FIE. They suggest that students with a mild developmental delay may need a longer and more intensive FIE program and that FIE may need to be modified for their specific needs. These authors also state that changes in self-concept may precede academic improvement, thereby explaining the lack of initial findings in academic areas.

In the only other published study located Harth, Johns, Cloud and Campbell (1981) report on an educational intervention based on FIE with students who have a learning disability. In this study students were given written instructions to "mediate" reading comprehension problems. On a paper-pencil reading comprehension exercise, the written instructions provided a problem-solving strategy for doing the exercises. Students did better with the written instructions than on other tasks without written instructions. The positive results are interpreted by the authors as supportive of the concept of FIE. This author is less certain the method employed is related to FIE at all.

The nature and purpose of educational assessment must be to determine appropriate goals and the most effective means of instruction. Not to determine, regardless of

either a static or dynamic mode of assessment, who has potential. Unfortunately models of assessment based on concepts of potential leave themselves open to having individuals being identified as lacking potential. A concept reminiscent of argumehts as to who is educable and who is not. This is a fundamentaly erroneous position in that everyone has learning potential (Baer, 1981). Feuerstein (1970) rarely discusses the implications for those deemed not to have potential except to suggest little more than a "rich" custodial existence for them. Rich and custodial being likely contradictory terms. Unfortunately measures of potential contain the seeds of educational disenfranchisement.

The published materials available on FIE provide very little information on prescisely how teachers are to produce insight, accomplish bridging and measure the occurrance of either. There is also little information on the criteria by which students are assessed as having mastered the instruments. While this information may be available elsewhere, it could not, unfortunately be considered in this review. Feuerstein (1979, 1980) provides no description of the precise matching of any of the FIE instruments to an individual on the basis of their LPAD profile. In fact Feuerstein (1977) states this is not necessary and the LPAD in itself may be a sufficient educational intervention by identifying potential.

Positive findings bring the resources to bear, as he notes in repeated anecdotal evidence, of a large variety of means to assist individuals. FIE is described as only one of the means that may be utilized educationally for a "culturally deprived" learner.

Another potential area of difficulty is the possibilty of "blaming" parents for the failure of cognitive development as they are often described as the primary source of the lack of MLE. This may be evidenced by the initial support of Feuerstein (1980) of residential environments over home environments. In the examples of individuals described by Feuerstein (1980), parents are sometimes noted for their "primitive" abilities with little evidence of home support or intervention being recommended. Stemming from this is a larger societal dilemna where Feuerstein (1980) suggests FIE may be more important than the moral need to alleviate poverty. Since poverty is too difficult a societal problem to solve, changing the individual to function better may be a more useful alternative. In this author's opinion poverty transcends learning difficulties in that only a small percentage of poor people are labelled as having a developmental delay and FIE does not feed and clothe people.

From a research perspective a number of issues present themselves. Chance (1981) notes that relatively few studies have been published given what would be expected of

a method in use for over ten years. As well he is critical of anecdotal success stories noting that they are common to all methods that serve large groups of individuals. Haywood and Arbitman-Smith's (1981) initial data is not particularly impressive and they suggest some difficulty in applying the material to students with a mild developmental delay contrary to Feuerstein's (1980) claims. Brandt (1981) states it is difficult to say if students become better thinkers from FIE as the "issues are murky and the evidence is conflicting".

The one major study reported on a group that had been streamed into a specific service model, Youth Aliyah. No comparisons are available for differently streamed groups. This may be of particular interest given the changes in Israeli society over time. The Sephardim position in society has been improving and they now constitute more than 50% of the Israeli population. Illiteracy for example was reduced by more than half during this time period (Time, 1984). Further, as noted in the review, children have the ability to overcome, with assistance, initial deprivational effects, and immigrant groups over time tend to adjust and perform better in their new culture. These variables need to be accounted for in subsequent studies.

No evidence is presented on the studied group's LPAD scores, if available, in relation to outcome. Almost all of the measures are static tests of which Feuerstein (1979)

is highly critical. Improvements in I.Q. scores would not seem to be a critical measure of the success of FIE. Measures of actual success on real life tasks and in out-of-school situations have not been conducted. A fundamental research issue that is partially addresed by this study is the lack of impact on curriculum bound material which must be considered more thoroughly in the future. Arguments that FIE reduces instructional time on curricular areas so that measurements of curricular success related to FIE must be viewed with some tentativeness are suspect. Before eliminating a content area we need to be certain that the replacement content is of sufficient power and effectiveness to warrant its inclusion.

In conclusion, the FIE model while philosophically appropriate raises a number of serious questions which must begin to be addressed given its rapid rise in prominence (Campione, Brown and Ferrera, 1982). This study attempts to address some of these questions in particular the effects of FIE on an functional vocational task, vocational performance in general (e.g., work habits and personal and social qualities) and academic achievement.

Chapter III

RATIONALE AND HYPOTHESES

Rationale

The supporting rationales for this study of the FIE method of instruction are discussed below. One of the critical areas of support for the experimental design is derived from the perspective that one of the primary purposes of schooling is to enable one to learn the skills necessary to be as successful in life as possible. In essence to perform well on out-of-school tasks (Rowher, 1970). To acquire the knowledge and thinking skills that enables one to know which strategies to use when faced with even novel problems and to be able to learn in out-of-school contexts (Feuerstein, 1980; Campione, Brown and Ferrara, 1982). As the literature review elucidated efforts to accomplish these goals have not been particularly successful for the population under study. The research with individuals who have a mild developmental delay strongly suggests that the emphasis in the future should be placed on training metacognitive skills and accompanying performance strategies (Borkowski and Cavanaugh, 1979; Belmont, 1978). Coupled with this suggested direction of training is the philosophical perspective that intelligent behavior can be taught, intelligence being neither fixed nor static (Feuerstein, 1979; Haywood and Wachs, 1981; Sternberg, 1981). FIE is

an intervention strategy designed to accomplish precisely the above stated goals and thus warrants attention as a focus of study (Vye and Bransford, 1981; Campione, Brown and Ferrara, 1982).

An additional supporting rationale is the paucity of experimental evidence at this time on the efficacy of FIE (Brandt, 1981). The implementation of this model at the cooperating vocational high school therefore merits, scientifically and ethically, appropriate examination as to the validity of the approach. This study is intended to contribute to the understanding of the value of FIE in the context in which it is being used. Some concern over the use of FIE with adolescents who have a mild developmental delay has been expressed (Haywood and Arbitman-Smith, 1981). Other supporting considerations include the fact that students taking FIE must forego a portion of their regular academic instruction and FIE teachers must make a substantial commitment in terms of time, implementation and follow through (Feuerstein, 1980). Only one major study has been completed on the use of FIE and that study was undertaken by its founder and his associates (Feuerstein, 1980; Feuerstein et al., 1981; Rand et al., 1981). Replication is required and on different groups in differing cultural milieus. While the FIE program is two years in length the measurement of effects at various points in time during (and after) the intervention can be

can be useful.

It is logical and necessary to expect to find progressive change over time during the application of any long term treatment or remediation method. It is unrealistic to suggest no change would be in evidence a day before the end of the program and then suddenly present the day after a two year intervention. In education generally if an instructional method applied on an almost daily basis for a year failed to produce student gains, then it would be highly suspect as a valid approach. This issue gains further importance for students who are at a disadvantage educationally, take longer to learn and therefore cannot afford to devote any time to an ineffective method. When over a reasonable length of time a method fails to produce change in the right direction an alternative method is implemented in its place, is added to the deficient method and/or the deficient method is revised. Therefore the analysis of the results of FIE during its implementation is of critical importance from a quality education perspective.

The gathering of information during the course of implementation maybe potentially useful in helping to determine future student participation. For example, it may pinpoint under what conditions a student should be terminated from the program, future benefit being unlikely given a certain rate of learning at a specific point in

time. The student might better profit from an alternative instructional method. This study of FIE, as part of a more long term analysis will begin to provide the above noted information useful in determining who should or should not receive FIE.

Of the evidence produced to date on the effects of FIE none has yet been related to measures of performance on functionally based tasks (Campione, Brown and Ferrara, 1982). Functional refers to those skills which the individual requires to function in current and subsequent natural environments (Brown et al., 1979). While many skills may be functional, some are more critical to learn that others. Critical skills tend to have a greater positive and meaningful impact for the individual, for example, leading to employment or increased independence (Sailor and Guess, 1983). The literature has expressed a concern about the lack of such ecologically valid outcomes in research studies with individuals who have a mental handicap (Brooks and Baumeister, 1977). For this study a vocational task that closely approximates a possible future job function for the subjects was designed as a means to assess the effectiveness of FIE (Appendix B). Employment is one of the critical purposes of the school program. Many of the supporting results for FIE have come from precisely the static type of testing of intellective measures that Feuerstein (1979; 1980) himself criticizes.

Assessing the effects of FIE on a functional vocational task, as this study does, is therefore consistent with the outcome measures desired by the literature and Feuerstein (1980) as interpreted by his criticism of traditional measures. This is perhaps the most important rationale underlying this study as it addresses the fundamental purpose of education, to result in truly meaningful gains.

While keeping in mind the need to have a task that is functional and a measure of far generalization, it is also imperative that the task be sensitive to possible FIE effects. The sensitivity of the selected experimental task is evidenced in a variety of ways. Part of the task requires paper and pencil responses in detecting intentional errors which is a feature of the very first FIE instrument, Organization of Dots, that students complete.

The role of error detection as a critical thinking skill has been discussed earlier. Feuerstein (1980) states that FIE will produce greater attention to accuracy and precision by the learner. The error production components of the Vocational Task are intended to measure this possible effect. During FIE students are required to discuss both solutions and errors. As part of the Vocational Task subjects are also required to describe verbally the salient features that make a diagram similiar to or different from its actual counterpart. Feuerstein (1980) further states that FIE results in a noticable

increase in purposeful and planned behavior, the strategies for which will generalize to tasks other than FIE. The Vocational Task was designed such that overt strategies were likely to be in evidence if the subjects were to accurately complete the task requirement. FIE students are supposed to place accuracy above speed (Feuerstein, 1980). This feature in combination with the strategies required for accurate mastery of the Vocational Task, results in an expectation that FIE students will take longer than other students to complete the task. One further feature is that the experimental task in this study taps most of the cognitive abilities that Feuerstein (1980) claims FIE teaches or restores (Appendix C).

Feuerstein (1980) states that FIE has a considerable number of positive behavioral spin-offs including:

i) Increased motivation

ii) Increased school attendance

iii) Heightened self-image

iv) Increased willingness to cope with school material

v) Lengthened concentration and attention span

vi) Pride in performance

vii) Increase in spontaneous corrections

viii) Readiness to read directions before starting

ix) Decreased dependency on the teacher

The Vocational Evaluation Rating Scale (VERS) (Appendix D)

was developed by the staff at the vocational high school as a regular means of assisting them in measuring student progress in the vocational classes. It rates behaviors in the areas of Personal and Social qualities, Work Habits, Work Skills and Overall Achievement which contain elements similar to the behaviors that Feuerstein (1980) reports results from the use of FIE. The previously cited major study on FIE (Feuerstein, 1980) included measures on classroom participation, adaptive and nonadapative classroom habits, and self-concept. In this study it would therefore seem appropriate to study the possible effects of FIE on similar general behavioral attributes in a vocational context and in classrooms other than those in which FIE is taught.

Achievement testing is ordinarily conducted at the beginning and end of each school year. These results provide a measure of student academic progress during the school year. This type of measure is also common in research designs, such as this, where teaching methods constitute the independent variables. Previous studies on FIE (Feuerstein, 1980; Haywood and Arbitman-Smith, 1981) report the effects or lack of effects on achievement. Further, it is necessary to ensure that student academic performance is not jeopardized by the introduction of FIE which requires a concurrent reduction in academic instruction. The vocational high school regularly uses

the Wide Range Achievement Test (WRAT) (Jastak and Jastak, 1978) and the Schonell Silent Reading Test. Results from the WRAT in the areas of mathematics, word recognition, spelling, and the Schonell Silent Reading Test will allow for comparison of the experimental and control conditions on academic performance, at least as measured by these instruments.

Hypotheses

On the basis of the stated supporting rationales, the following post intervention hypotheses have been proposed:

Vocational Task

Error Detection

Hypothesis 1

There will be significantly less mean total errors produced in detecting errors by the experimental group as compared to the control group.

Hypothesis 1.1

There will be significantly less mean errors on each error detection diagram in favour of the experimental group over the control group.

Descriptive Descrimination

Hypothesis 2

There will be a significantly greater mean total

number of questions answered correctly describing the discriminative elements of the pinpointed circuits by the experimental group compared to the control group.

Circuit Board Construction

Hypothesis 3

There will be significantly less mean total errors in circuit board construction for the experimental group as compared to the control group.

Hypothesis 3.1

There will be significantly less mean errors on each constructed board in favour of the experimental group.

Hypothesis 3.2

There will be a significantly greater mean amount in the total time taken to construct the circuit boards for the experimental group in comparison to the control group.

Overt Strategies

Hypothesis 4

There will be a significantly greater mean number of overt strategies used to construct the circuit boards by the experimental group as compared to the control group.

Vocational Evaluation Rating Scale (VERS)

Hypothesis 5

There will be a significantly greater mean score as

measured, on all four areas of the VERS (Personal and Social Qualities, Work Habits, Work Skills, and Overall Achievement) for the experimental group as compared to the control group.

Hypothesis 5.1

There will be a significant difference in favour of the experimental group as compared to the control group on the following isolated measures of the VERS:

a) sociability with fellow students
b) attendance
c) flexibility
d) initiative
e) following oral directions
f) quality of work
g) quantity of work

Wide Range of Achievement Test (WRAT) and Schonell Reading Test (SLR)

Hypothesis 6

There will be no significant difference of standard scores on the arithmetic, spelling and reading subtests of the WRAT and on the SLR by the experimental group in comparison to the control group.

The next chapter details the methodology for this study which is consistent with the stated supporting rationales and the accompanying hypotheses.

Chapter IV

METHOD

Subjects

The subjects were 24 junior high school students in their first year of a segregated vocationally based training program for students who are identified as having a mild deveopmental delay. Initially five students were randomly selected from each of six first year classes (two students, one from each condition, were unavailable for posttesting and were excluded from all analyses) which had an average of approximately 10 students per class. At the beginning of the school year the school administration identified three classes as experimental, to receive FIE and three as control, to receive the regular curriculum. One of the experimental classes only sporadically covered one-third of the FIE curriculum that the other two experimental classes completed systematically. This class of four students was therefore removed from the study and information on thes class is not reported. This left, from the original group of 30 students, a total of 24, with 14 in the control group and 10 in the experimental group. Tables 2 and 3 present an overview of subject characteristics with respect to age and the most recent I.Q. scores on file at the school.

TABLE 2

AGE AND I.Q. RANGE AND GENDER

Condition	Gender		Age	I.Q.
	F	M	Range (years)	Range
RI	6	8	11.7 - 13.2	60 - 91
FIE	5	5	11.6 - 12.9	56 - 79
RI and FIE	11	13	11.6 - 13.2	56 - 91

TABLE 3

MEAN AGE, I.Q. SCORES AND STANDARD DEVIATIONS

Condition	No.	Age (years)		I.Q.	
		Mean	s.d	mean	s.d.
RI					
Class 1	5	12.600	.534	71.000	3.742
Class 2	5	12.340	.439	74.200	11.167
Class 3	4	12.250	.580	70.250	7.848
Group	14	12.407	.498	71.929	7.751
FIE					
Class 4	5	12.560	.305	64.600	8.905
Class 5	5	12.080	.563	69.200	6.648
Group	10	12.320	.483	66.900	7.795
RI and FIE	24	12.371	.483	69.833	8.009

Appparatus and Stimuli

Feurstein's Instrumental Enrichment Program (FIE)

All students in the experimental group completed the first two instruments, Organization of Dots and Organization in Space I of the FIE program. Appendix E contains sample pages from those two instruments. The remainder of the curriculum was the same as that provided for the control students.

Regular Instruction (RI)

All control group students received the regular first year curriculum offered by the cooperating vocational high school. The curriculum, which is provincially approved and assigned by the Alberta Department of Education, includes the following subject areas:

1) communication - reading, oral language, writing, and listening skills

2) human relations - social interactions with peers and others

3) mathematics - computation, measurement, time telling, and money skills

4) science - observation skills and experimental projects

5) fine arts - music and drama, art, multi-lab (crafts with leather, metal and plastics)

6) physical education - gross motor skills and games

7) vocational skills - sewing, woods and cooking

Vocational Task

As previously indicated, there have been no efforts to assess the impact of FIE (Feuerstein, 1980) on ecologically valid tasks. The research measures utilized to date have consisted largely of intellective measures that do not allow for an accurate interpretation of how students actually use FIE taught strategies. Feuerstein's (1979; 1980) own criticism of static measures of intelligence also lends support to the design of this study's Vocational Task. The Vocational Task designed for this study was carefully selected for its functionality (i.e., possible future job) and sensitivity to demonstrable FIE effects. Electronic circuit board construction and its related aspects, which has been utilized previously with subjects that have a developmental delay (Levy, Pomermantz, and Gold, 1977), requires many of the same skills that FIE demands and is a possible marketable skill given the current and probably future emphasis on high technology industries. The Vocational Task has been divided into four measures. The components that account for these measures are described below.

Error Detection

The apparatus for this part of the vocational task consisted of four circuit boards of increasing size, each of which contained a specified number of differing electronic circuits (Appendix B). The first board is used

for a teaching purpose which is described in the procedural section. This first board is only used in the error detection component of the Vocational Task. Each board was designed to be more complex than the preceeding by virtue of an increase in circuit numbers and type of circuit (e.g., smaller, finer elements). Each board was mounted on a 2" x 4" piece of wood at an angle of 45° away from the subject. Each board was also bordered on both ends by a gray plastic cover one-half inch in width. For each of these boards there is a corresponding diagram, the same size as the board drawn in black and centered on plain 8 $^{1}/_{2}$" x 11" paper (Appendix B). Each diagram portrays the circuits on corresponding the boards with some of the circuits drawn correctly, some incorrectly and some not drawn at all. For posttesting, the first two boards and diagrams were altered to offset possible learning effects. The first board retained the same degree of difficulty, the second increased in complexity, the number of circuits remaining the same. Students were also provided with pencils and erasers.

Decriptive Descrimination

This task component utilizes the same materials as in the error detection component. One circuit from each of the three boards (the first teaching board being included) is used in conjunction with the corresponding diagram. Appendix B details the specific circuits used in this

Vocational Task Component.

Circuit Board Construction

For this task the three circuit boards were used along with three empty boards of exactly the same dimensions and mounted in the same way. Each of these empty boards actually consisted of two boards held together by plastic borders with onion skin paper cut to size sandwiched between the two. The boards were perfectly aligned hole for hole with a new onion skin inserted for each trial. Corresponding to each set of boards was a set of unmounted circuits that matched the already installed circuits. These sets also contained additional circuits both the same and different than the installed circuits. Each set was contained in a clear plastic cylindrical bottle.

Overt Strategies

The apparatus and stimuli for this measure are exactly the same as used for the Circuit Board Construction. During Circuit Board Construction subjects were also measured for the occurrance of Overt Strategies. This procedure is described in detail in the subsequent section of this chapter.

Vocational Evaluation Rating Scale (VERS)

At the end of each trimester, every student is

assessed according to a rating form developed by the staff at the vocational high school (Appendix D). This assessment is a regular procedure at the school and was not developed specifically for this study. As it is used by the school to determine student progress in the vocational domain it constituted an appropriate measure for inclusion in this study. Utilizing the school's own method for assessing the effectiveness of its regular program provides for a ready comparison to the FIE program. The construction of the VERS was based on the teachers interpretation of critical areas and did not include any procedures for assessing reliability or validity. The scale is divided into four areas: Personal and Social Qualities, Work Habits, Work Skills and Overall Achievement. Each area is divided into separate elements which are scored individually. Two of these elements, Ability to follow written directions and Ability to use proper terminology from the Work Skills area were not scored adequately and as such were excluded from any analyses.

Achievement Tests

The school regularly assesses student progress by the administration of standardized achievement tests at the beginning and end of each school year. For this study the results of two achievement tests were available. These were the Wide Range Achievement Test (WRAT) (Jastak and

Jastak, 1978) and the Schonell silent reading test. As stated previously it is appropriate to include measures the school already uses in assessing its own program as another comparison measure to FIE.

The WRAT is an individually administered test that provides ability measures in the areas of reading, spelling and arithmetic. The test has a number of significant limitations. Salvia and Ysseldyke (1982) state that the WRAT is not properly normed as no effort was made to establish a national representative sample. They also state that the WRAT lacks validity and reliability. Sattler (1982) is critical of the WRAT as well, indicating that it underestimates ability, lacks diagnostic utility and specific instructional objectives. The lack of utiity is derived from the limited behavior sampling (Salvia and Ysseldyke, 1982). Reading, for example, is only measured by counting the number of words in isolation that a student correctly recognizes. Even this is further limited in that a low score would not differentiate word attack skill deficiencies.

PROCEDURE

Feuerstein's Instrumental Enrichment (FIE)

The Two FIE classes were taught by teachers trained in approved FIE summer workshops. One teacher had completed the first level of training which is the minimum required to teach FIE. The second teacher had had more experience

with FIE and had completed the second level of training. During the school year FIE was taught four to five times per week in one class and three to four times in the other for 40 to 60 minutes first thing each morning. Students in one experimental class missed Human Relations and Science while the other class missed Mathematics and Science as these subjects were taught during the morning. The FIE students attended vocational classes in the afternoon. All non-FIE classes had the same content as the regular program.

While there is no set script for conducting a FIE lesson, Feuerstein (1980) offers the following general guidelines:

1. Preparation for the lesson - lessons must be planned in advance so that the teacher knows the precise objective, parameters of the lesson in relation to the cognitive map (i.e., each mental act can be divided into content, operations, modality, phase, complexity, abstraction and efficiency), strategies and didactics to be used and examples of the principles as they relate to academic, vocational and real life situations.

2. Presentation of the Lesson:

a) 10 minute introductory discussion to define objectives and arouse motivation

b) independent work for 25 minutes

c) development of insight by discussion of various solutions and divergent thought processess

d) five minute summary.

3. Flexibility - willingness to digress and modify lesson plans according to needs of students.

4. Individualized Remedial Work - to be provided as needed according to specific instruments on which difficulty is encountered.

5. Teacher Role - Certain of the goals within FIE are highly dependent on the teacher and not as directly dependent on the written materials. These are: helping students acquire the necessary vocabulary and operations; production of insight; "bridging" from written materials to everyday life; and producing and sustaining motivation. A critical component of teacher training for FIE is the ability to establish insightful processes in the child which can then be used to generalize the learned principles from the material to everyday life situations. Bridging requires "the relevant, actual illustration, or rephrasing of a verbal statement expressing a new idea" (Feuerstein, 1980). The teacher guides the student from more immediate task-bound concepts to abstract concepts and their meaningful application. As such, the teacher must be well trained in the application of FIE and the strategies necessary for producing transfer of the principles.

Regular Instruction

The regular program has the academic subjects taught

during the morning and vocational classes in the afternoon (i.e., cooking, sewing and woods). For vocational training all students were on a trimester rotation so that every student would take all three areas. Students also took find arts and physical education. All classes for both conditions were taught by Provincially certified teachers.

Vocational Task

All subjects were tested individually in a small room at the school seated at a desk or a table. Pretesting was conducted during the month of December and posttesting in June. The procedure was the same for the pretesting and posttesting. Vocational Task components were always presented in the same order: Error Detection, Descriptive Descrimination and Circuit Board Construction. Overt Strategies were recorded during Circuit Board Construction. The scoring procedures for each component of the Vocational Task were developed from the Pilot Study described in Appendix F.

Error Detection

Subjects were presented with a board, and the corresponding diagram. They were told that the diagram was a drawing of the circuit board placed in front of them. The experimenter explained that some of the circuits were drawn correctly and that some were drawn wrong or were

incorrect. Subjects were instructed to put an 'X' through the circuit drawing or drawings that were drawn incorrectly (i.e., did not look like the circuits on the board). Subjects were free to manipulate the materials as they chose. They were instructed to indicate verbally when they had completed the task at hand.

There was no feedback on performance at the end of each task except as indicated below. Subjects were thanked for their effort, presented with the next board and the accompanying stated directions. Subjects were given verbal encouragement (i.e., good work) a maximum of twice during each task. This was only provided after a subject had made a correct response to avoid potentially reinforcing an incorrect response.

The first diagrams, pre and post, were presented as a teaching tool to ensure the subjects understood the error detection task. The first diagrams and corresponding boards were used only for the Error Detection component of the Vocational Task. In addition to the general procedure noted above upon presentation of these diagrams and boards, subjects were told they would receive help if needed. At the conclusion of these first diagrams and boards the experimenter reviewed the subjects correct and incorrect responses with them as a means of ensuring their understanding. As the diagrams for these boards did not represent missing circuits subjects had no prior training

or feedback on this type of error detection. The diagrams were constructed this way to maintain a degree of difficulty and novelty for testing purposes.

The following error information was recorded for each diagram: failing to detect an incorrectly drawn circuit; failing to identify a missing circuit as incorrect; and identifying a correctly drawn circuit as incorrect. Each error counted for a score of one. Errors were totalled for analysis.

Descriptive Descrimination

Upon completion of the Error Detection component subjects were asked to explain for a specific circuit (Appendix B) from the three diagrams and their corresponding boards, why they had scored the circuit diagram as correct or incorrect. The phrasing of the question was dependent on how the subject had scored the specific circuit diagram during Error Detection. If the subject had scored the circuit diagram correctly the question was phrased for them to simply explain why had they scored it as "the same or different". If the subjects had scored the circuit diagram incorrectly the question had to be slightly re-phrased asking them first if the circuit and the diagram were the same or different and then asking them to explain why. This re-phrasing was found to be necessary from the pilot study (Appendix F). Correct and

incorrect responses to the questions were recorded, counted as one point each, and the total correct score utilized for data analysis.

Circuit Board Construction

For this part subjects were presented, with the three circuit boards, the corresponding empty "sandwich" boards, and the corresponding set of circuits. Subjects were told to use the set of given circuits to complete the empty board so that it looked "exactly" like the completed board. The instructions were repeated for each board and the word "exactly" emphasized. They were advised that they would be given assistance if the wires of the circuit bent during installation. The experimenter would straighten the wires with pliers when necessary. Subjects were also told that the circuits did not have to be pushed flush with the board but simply inserted in the holes. They were told when to begin and to indicate verbally when they had finished. Subjects received up to three phrases of verbal encouragement during each unit with the same proviso as noted earlier.

The following error production information, derived by comparing the holes made in the onion skin paper by the circuits with a master sheet indicating correct placements, was recorded with each error being scored as one point:

a) failing to place a circuit

b) using an incorrect circuit

c) orienting a circuit incorrectly

d) spatial error placement

i) first board - circuit placed more than 6mm from the correct position

ii) second board - circuit placed more than 8mm from its correct position

iii) third board - circuit placed more than 10mm from its correct position.

e) placing an unused circuit (i.e, circuit not found on the circuit board).

Errors were totalled for analysis purposes.

The total possible errors vary from board to board as the number of circuits is different for each board (Appendix B). This is further complicated by the fact that failing to place a circuit can reduce the total errors. For example, an error score of one was given for a missing circuit but if a circuit was placed incorrectly in terms of orientation and spatial location this was counted as a score of two. The results of the pilot study demonstrated that the number of missing circuit errors produced was small. The time taken to build each was recorded and the cummulative time for all boards were analysed for possible FIE effects on accuracy versus speed.

Overt Strategies

The Circuit Board Construction component was designed so that accurate construction required the use of Overt Strategies. As noted earlier FIE (Feuerstein, 1980) is supposed to result in generalizable problem solving strategies. This part of the Vocational Task was designed to elicit the following strategies:

a) Measurement - necessary for determining the exact position of the electronic circuits

b) Match to sample - used to determine if the electronic circuit to be placed is the correct one when compared to given sample

c) Correction - a function of self-monitoring, checking work, recognizing errors and correcting same

d) Rejection - correctly recognizing that some electronic circuits were not required

e) Self-instruction - guiding oneself by audible verbal statements (e.g., "that one doesn't go there")

f) Placement - placing the largest pieces first is possibly evidence of a strategy which creates referents for the placement of smaller electronic circuits

g) Counting - audibly counting or by pointing to ensure correct number of electronic circuits have been placed.

The following Overt Strategies were recorded if observed at least once when subjects were constructing any

of the three boards. Subjects received only one point for each Overt Strategy utilized even if the strategy occurred more than once.

1. Measurement

a) using fingers to measure distance between circuits

b) counting spaces for distance measurement

c) using a ruler to measure distance (available if asked for).

2. Match to sample

a) subject holds circuit up to an installed circuit to ensure mathcing

b) subject uses finger or pencil to point from installed circuit to a circuit to be installed.

3. Correction - during or after placement of a circuit subject repositions circuit

4. Rejection - subject does not install extra unneeded circuits

5. Self-instruction - subject audibly instructs self

6. Placement - subject begins board by placing largest piece first.

7. Counting - subject audibly counts circuits and/or uses finger or pencil to count circuits to determine if sufficient number of circuits placed.

The number of total strategies observed were calculated for data analysis.

Vocational Evaluation Rating Scale

This form was completed in November 1983, March 1984 and June 1984 by the vocational subject teacher that each student had during the preceeding trimester. Only those completed during November and June were utilized in order to allow for maximum possible effect. Completion of the form is largely subjective as there are no written guidelines or operationally defined behavioral objectives. Scores for each section of the form were arrived at by totaling the number of points received. The last section, Overall Achievement, was scored by assigning points as follows: A = 4, B = 3, C = 2, and D = 1.

Attendance, was not included in the total score for Work Habits as it was not scored by the teachers completing the form. Teachers recorded the number of days of attendance out of actual school operation days. This figure was computed to a percentage and attendance was analysed as a separate entity. The item entitled Following written directions was not included as part of the total score for Works Skills or in any analysis as it was only sporadically scored for a few students. The same applies to Ability to use proper terminology. The item, Following oral directions was not included in the total of Work Skills either but was analysed separately due to the small number of students to whom it was applied. In an effort to increase the sensitivity of this device to possible FIE

effects the following procedure was conducted. Select individual elements were extracted from the VERS and analysed individually. Some of the elements had to be treated singularly as they were scored that way (i.e., Attendance) or were scored only on a small number of students (i.e., Following oral directions). In any regard the results of most of the singular element analyses must be viewed with some tentativeness given the questionable validity of one element measuring a broad concept such as sociability. The following are the elements analysed singularly: Sociability with fellow students; Attendance; Flexibility; Initiative; Following oral directions; Quality of work; and Quantity of Work.

Achievement Tests

These tests were administered and scored according to their standardized procedures by the first year teachers. The tests were administered in November and June. The author converted all grade scores on the WRAT to standard scores in order to ensure appropriate analysis.

The following chapter details the results obtained from the described method which was designed to assess the effectiveness of FIE in comparison to the RI program, in particular on a functional vocational task.

Chapter V

RESULTS

The results of this study are presented in a manner which corresponds as closely as possible to the stated hypotheses. The first section of this chapter presents an analysis of the homogeniety of the control and experimental groups. The subsequent sections detail the pre and posttesting results of the Vocational Task, the Vocational Evaluation Rating Scale including isolated factors and the results of the Achievement Tests.

Homogeniety of Subjects

Subjects were randomly selected to participate in this study and randomly assigned to control and experimental classes by the school administation. It was, nevertheless, essential to ensure there were no significant initial differences between the two groups on the critical variables under study. No significant differences were found on the basis of age between the control and experimental subjects ($t = .4204$, $p > .05$) and I.Q. ($t = 1.5619$, $p > .05$).

Further analyses were conducted on all pretest scores to determine if there were significant differences on any other measures. The experimental subjects had received some FIE at the point of pretesting and as such there might have been significant differences at the outset of the

study. Of 31 pretest measures conducted only two were found to be significant. The RI group had a significantly better pretest score on the Work Skills part of the VERS ($t = 2.728$, $p<.05$; Table 9). On the isolated factor of Following oral directions, the control group had a pretest mean of 2.46 and the experimental group a mean of 1.78 (Table 10). This difference was found to be significant ($t = 2.8991$, $p<.05$). The remaining pretest scores did not vary significantly (Table 4-19).

Within the school a number of students had been identified from the total school population by the staff as in need of occupational therapy assessment. This included ten students from the control group and seven from the experimental group. Due to the fact that fine motor performance might affect the results on the Circuit Board Construction of the Vocational Task and vocational performance in general, their scores were compared across groups for possible significant differences. All the identified students were assessed on the Briuniks-Oseretsky fine motor test. No significant differences were found between the two conditions ($t = .7621$, $p>.05$).

Given the above results the two groups of subjects can be described as homogeneous and therefore any significant findings between groups cannot be attributed to initial group differences.

Vocational Task

Error Detection

The first results discussed concern the total error score for the Error Detection component where subjects had to compare diagrams to actual circuit boards for correctness. The posttest scores from each diagram were summated and analyzed (Table 4). The posttest total mean score for the control group was 12.71 and for the experimental group 13.10. No significant differences were obtained between the control and experimental conditions ($t = .1862$, $p > .05$).

In an effort to provide additional information, the pre and posttest total mean scores were compared within each of the two conditions, RI and FIE using correlated t-tests. Correlated t-tests were used for every pre to post comparison within groups. Some significant findings were obtained. Both the RI and FIE groups improved significantly on the total score, resulting in less errors pre to post. The difference for the RI group was somewhat more significant. The RI group pretest mean was 15.71 and posttest 12.71 ($t = 3.376$, $p < .01$). The FIE group pretest mean was 16.50 and posttest 13.10 ($t = 2.3470$, $p < .05$). A two-way analysis of variance was conducted with the pre and posttest results as repeated measures. (All two-way analysis of variance reported herein were conducted

TABLE 4

Mean pre and post error scores and t-scores for the Error Detection component of the Vocational Task

		Error Scores				t-values		
		Pre		Post		RI and FIE	RI vs FIE	
Diag.	Cond.	M	s.d.	M	s.d.	Pre-Post	pre	post
1	RI	1.57	1.34	1.07	.77	1.336		
	FIE	1.20	.79	1.80	1.23	1.1767	.8474	1.7267
2	RI	3.07	1.77	2.64	1.39	1.270		
	FIE	2.70	1.64	2.30	1.34	1.1721	.5271	.6033
3	RI	5.00	1.36	4.43	1.83	.949		
	FIE	5.70	1.49	4.30	2.41	2.1433	1.1763	.1463
4	RI	6.07	1.68	4.57	2.06	4.486***		
	FIE	6.90	1.60	4.80	2.39	2.3333*	1.2270	.2460
TOTAL	RI	15.71	3.52	12.71	4.70	3.376**		
	FIE	16.50	4.35	13.10	5.30	2.3470*	.4740	.1862

* p <.05
** p <.01
*** p <.001

similarly.) A significant main effect was found for the instructional methods, $F(1,46) = 12.0659$, $P<.01$ (Figure 2, Table 5).

This section describes the results on the four individual diagrams (Table 4). No significant posttest differences were found for any of the four diagrams. Analysis of pre to post mean error scores for each diagram yielded significant results only on the last diagram (No. 4, Appendix B) and for both conditions. As in the total error score comparison, pre to post, the RI group difference was more significant than that demonstrated by the FIE group. The RI group pretest mean was 6.07 and posttest was 4.51 ($t = 4.486$, $p<.001$). The FIE group pretest mean was 6.90 and posttest was 4.80 ($t = 2.333$, $p<.05$).

Descriptive Discrimination

Subjects were asked to describe the difference or similarity between a circuit diagram and an actual corresponding circuit from the three diagrams used for this part of the Vocational Task. Their answers were scored as correct and incorrect with the total correct being reported. No significant posttest results were obtained (Table 6). The control group had a mean of 2.57 and the experimental 2.80 ($t - 1.0621$, $p>.05$). The RI group did improve significantly on pre to posttest performance, from

TABLE 5

ANOVA for Error Detection Data

Involving 2 (instructional methods)
x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/46	112.667	.925
Error	46	121.775	
Within			
Methods	1/46	63.336	12.066**
Error	46	5.249	
Interaction	1/46	.167	.032

**p<.01

Figure 2. Mean scores obtained at pre and posttesting for Error Detection with the two instructional methods (FIE and RI).

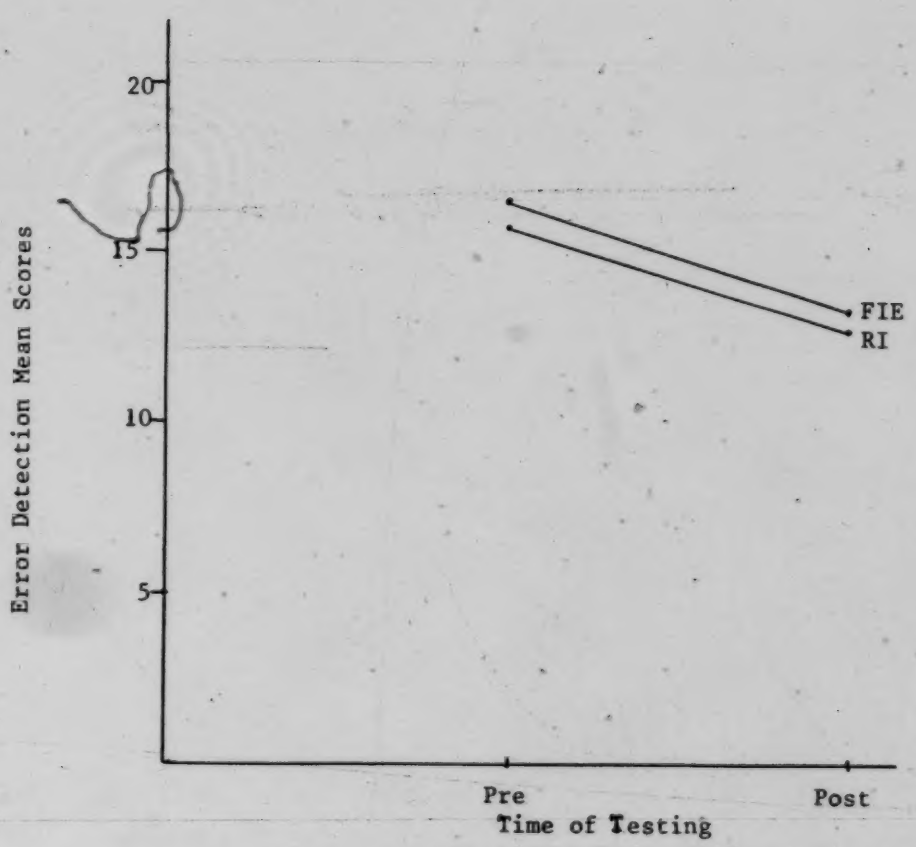


TABLE 6

Mean pre and post total scores and t-scores for the Descriptive Descrimination component of the Vocational Task

Questions	Cond.	Correct Responses Pre M	Pre s.d.	Post M	Post s.d.	t-values RI and FIE Pre-Post	RI vs FIE pre	RI vs FIE post
TOTAL	RI	2.07	.83	2.57	.65	2.876*		
	FIE	2.60	.70	2.80	.42	1.5000	1.6913	1.0621

a mean of 2.07 to 2.57 ($t = 2.876$, $p<.05$). The FIE group also improved but not significantly. The two way analysis of variance yielded a significant main effect for the instructional methods, $F(1,46) = 8.8264$, $P<.01$ (Figure 3, Table 7).

Circuit Board Construction

The same method of analysis was performed on the pre and posttest results (Table 8) of this part of the Vocational Task as was done for the Error Detection scores. Examination of the total posttest scores across all three boards yielded no significant differences between the control group which had a mean of 24.93 errors and the experimental group which had a mean of 24.43 ($t = .0069$, $p>.05$). The same lack of significant findings held when all three boards were analyzed individually on posttest scores. The two-way analysis of variance did not yield any significant findings (Table 9).

Pre to posttest analysis of scores for the RI and FIE groups respectively did not indicate any significant difference on either the total error scores or the scores for any of the three individual boards (Table 8). Raw scores did indicate that the experimental group improved pre to post on all three boards with a total error reduction of 3.56 while the control group's performance deteriorated on two boards with an increase of .44 errors

TABLE 7

ANOVA for Error Detection Data

Involving 2 (instructional methods)

x 2 (pre and posttest measures

Source	df	MS	F
Between			
Measures	1/46	1.260	.352
Error	46	3.581	
Within			
Methods	1/46	.8438	8.826**
Error	46	.0956	
Interaction	1/46	.2604	2.724

**p<.01

Figure 3. Mean scores obtained at pre and posttesting for Descriptive Discrimination with the two instructional methods (FIE and RI).

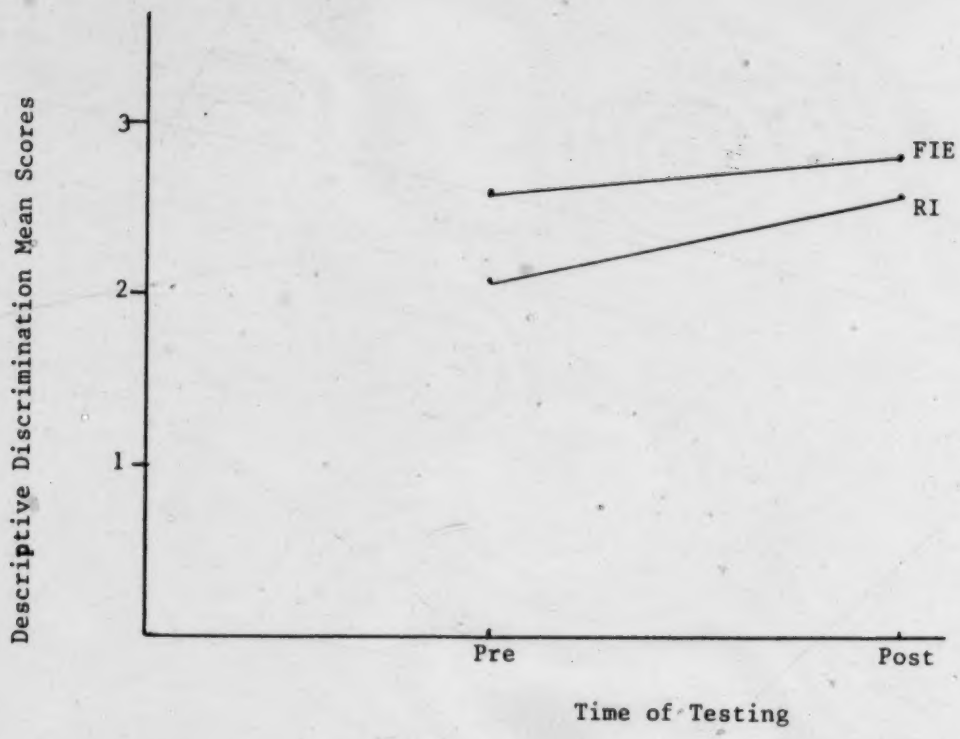


TABLE 8

Mean pre and post error scores and t-scores for the Circuit Board Construction component of the Vocational Task

		Error Scores				t-values		
		Pre		Post			RI vs FIE	
Board	Cond.	M	s.d.	M	s.d.	RI and FIE Pre-Post	pre	post
1	RI	5.21	2.61	6.36	2.56	2.042		
	FIE	6.80	1.48	6.70	2.50	.1068	1.8928	.3252
2	RI	7.07	2.79	7.36	2.92	.390		
	FIE	8.40	2.41	7.40	5.10	.7798	1.2474	.0223
3	RI	12.21	4.56	11.21	5.07	.764		
	FIE	14.10	4.75	10.80	5.20	1.6498	.9771	.1924
TOTAL	RI	25.21	8.73	24.93	9.10	.158		
	FIE	29.30	6.82	24.90	11.38	1.3503	1.2873	.0069

TABLE 9

ANOVA for Circuit Board Construction Error Data

Involving 2 (instructional methods)

x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/46	304.343	.8011
Error	46	379.925	
Within			
Methods	1/46	36.260	2.723
Error	46	13.318	
Interaction	1/46	49.594	3.724

taking into account all three boards. As just noted these results were not significant.

The results of the time taken to complete the circuit board construction were analysed according to the same format reported above. Posttest analysis did not yield any significant findings when comparing the total mean time ($t = .0666$, $p > .05$) or the mean time for any of the individual boards (Table 10). Analysis of pre to posttest differences within groups did not produce significant results for any of the boards individually or in total (Table 10).

The FIE group increased its mean time pre to post on two of the boards while decreasing on one board and on total mean time. The RI group increased its mean time pre to post on one board while decreasing on the remaining measures. As noted previously these differences were not significant.

Overt Strategies

The total number of observed strategies were recorded and compared on a posttest and pre to posttest basis (Table 11). Posttest analysis between the control group (posttest mean = 3.64) and the experimental group (posttest mean = 3.90) produced no significant difference ($t = .2526$, $p > .05$). The pre to posttest analysis for each of the conditions failed to yield significant results although mean score figures showed a reduction of .22 in overt strategies for the control group and a .30 increase for the

TABLE 10

Mean pre and post times and t-scores for the Circuit Board Construction component of the Vocational Task

		Error Scores				t-values		
		Pre		Post			RI vs FIE	
Board	Cond.	M	s.d.	M	s.d.	RI and FIE Pre-Post	pre	post
1	RI	272.71	169.26	231.71	105.83	1.567		
	FIE	249.40	93.66	257.40	54.00		.4311	.7776
2	RI	302.71	180.00	236.79	84.23	1.802		
	FIE	263.60	99.73	226.70	69.29		.6799	.3212
3	RI	321.28	222.50	460.71	627.99	1.024		
	FIE	249.10	93.56	265.30	111.96		1.0867	1.1392
TOTAL	RI	896.71	550.74	743.36	281.44	1.604		
	FIE	787.0	256.66	749.40	189.62		.6756	.0666

TABLE 11

Mean pre and post total score for the Overt Strategies component of the Vocational Task

Strategies	Cond.	Overt Strategies Pre M	Pre s.d.	Post M	Post s.d.	t-values RI and FIE Pre-Post	RI vs FIE pre	RI vs FIE post
TOTAL	RI	3.86	1.03	3.64	1.28	.506		
	FIE	3.60	.84	3.90	1.10	.7579	.6799	.2526

experimental condition. The two way analysis of variance did not produce any significant results (Table 12).

Vocational Evaluation Rating Scale

Personal and Social Qualities

The control group's posttest mean score of 19.92 was not found to be significantly different from the posttest mean score of 22.44 obtained by the experimental group ($t = 1.3295$, $p > .05$, Table 13). The pre to post analysis also failed to provide significant results for either condition although the control group showed a decline of .57 while the experimental group increased by 3.11. The two-way analysis of variance yielded a significant interaction between instructional methods and pre to posttest scores on this factor, $F(1, 42) = 4,1978$, $p < .01$ (Figure 4, Table 14).

Work Habits

Attendance is reported as a separate item and is not included as a factor in this section. There was no significant posttest difference ($t = 1.1781$, $p > .05$) with the control group having a mean of 19.08 and the experimental 21.89 (Table 13). Pre to posttest comparison did yield significant results for the FIE groups ($t = 3.3645$, $p < .01$) but not for the RI group. Mean scores represented a 1.46 decline in performance for the control

TABLE 12

ANOVA for Overt Strategies Data

Involving 2 (instructional methods)

x 2 (pre and posttest measures

Source	df	MS	F
Between			
Measures	1/46	10.667	1.347
Error	46	7.919	
Within			
Methods	1/46	.042	.074**
Error	46	.560	
Interaction	1/46	.167	.298

TABLE 13

Mean pre and post scores and t-scores for the Vocational Evaluation Rating Scale (VERS)

		Error Scores				t-values		
		Pre		Post		RI and FIE	RI vs FIE	
Area	Cond.	M	s.d.	M	s.d.	Pre-Post	pre	post
PERSONAL AND SOCIAL QUALITIES	RI	19.92	5.36	19.08	3.75	.5617		
	FIE	19.33	6.84	22.44	6.91	2.1718	.2168	1.3295
WORK HABITS	RI	20.54	4.01	19.08	3.38	1.021		
	FIE	17.11	4.54	21.89	6.58	3.3645**	1.8264	1.1781
WORK SKILLS	RI	14.23	3.27	14.54	2.93	.060		
	FIE	11.56	2.24	14.78	4.82	1.6425	2.728*	.1333
OVERALL ACHIEVE-MENT	RI	5.00	1.35	5.23	1.30	.570		
	FIE	5.11	1.90	6.00	2.00	.4666	.1495	1.0159

* $p < .05$
** $p < .01$

TABLE 14

ANOVA for VERS Personal and Social Qualities

Involving 2 (instructional methods)

x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/42	195.011	.8359
Error	42	233.295	
Within			
Methods	1/42	3.284	.7976
Error	42	4.117	
Interaction	1/42	17.284	4.198*

*p<.05

Figure 4. Mean scores obtained at pre and posttesting for Personality and Social Qualities with the two instructional methods (FIE and RI).

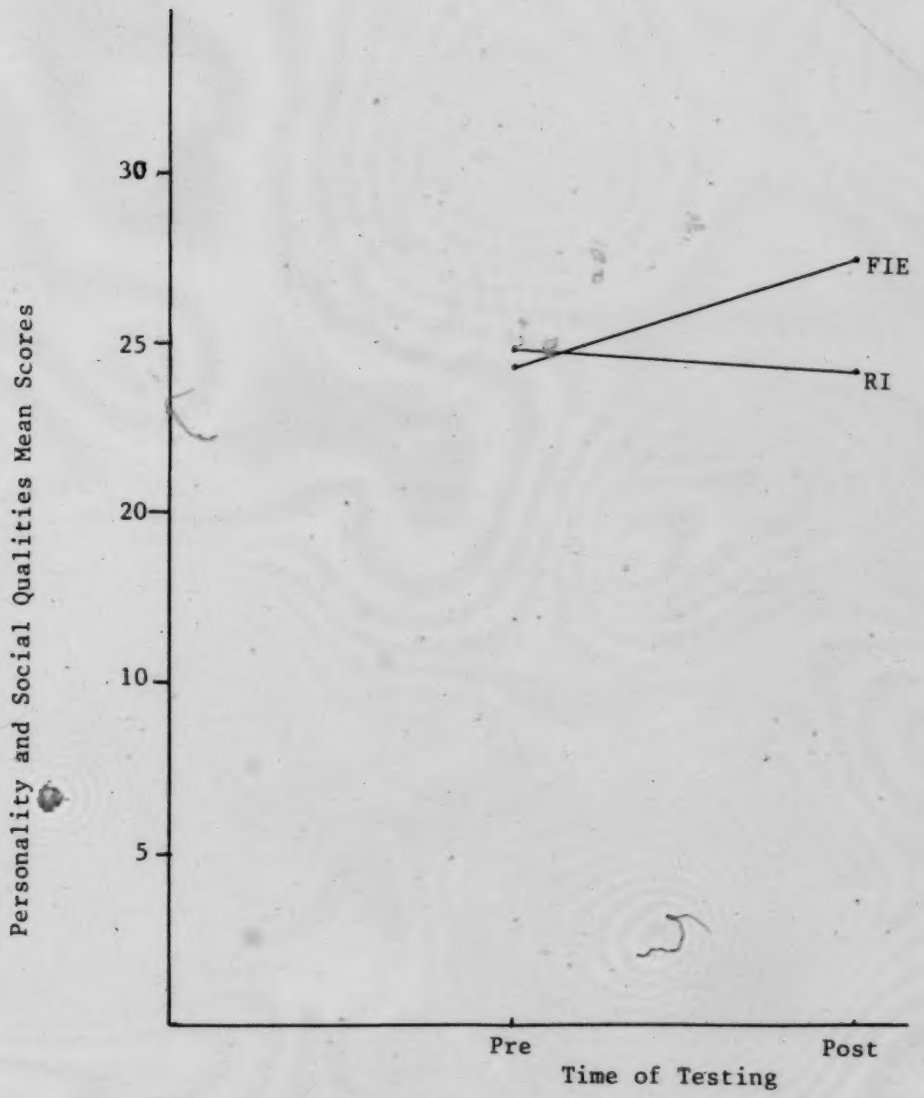


TABLE 15

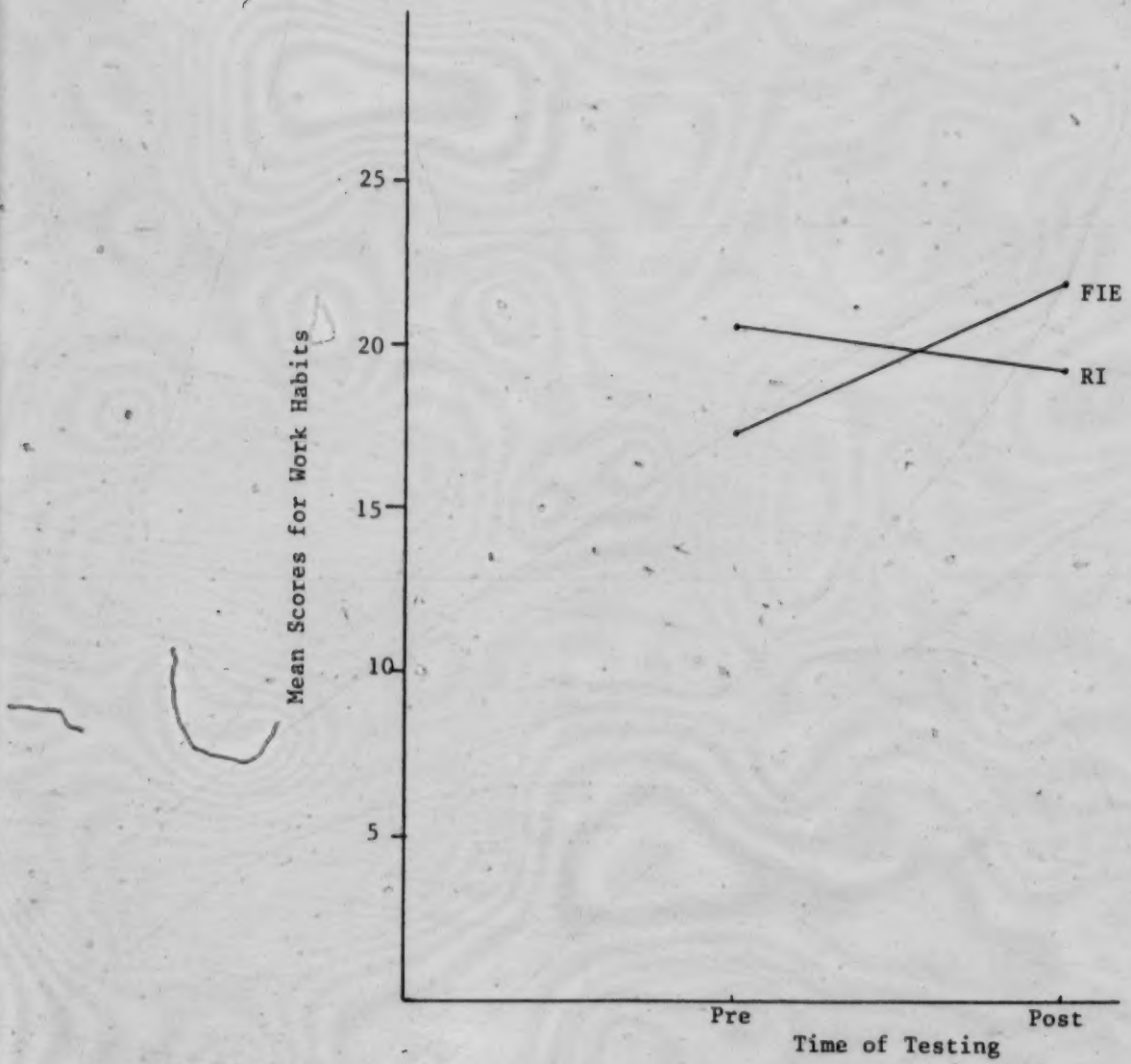
ANOVA for VERS Work Habits Data

Involving 2 (instructional methods)
x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/42	283.682	1.348
Error	42	210.467	
Within			
Methods	1/42	10.227	1.290
Error	42	7.934	
Interaction	1/42	52.545	6.623*

*p<.05

Figure 5. Mean scores obtained at pre and posttesting for Work Habits with the two instructional methods (FIE and RI).



group pre to post with a 4.78 increase for the experimental group. A significant interaction effort, $F_{(1,42)} = 6.6228$, $p<.05$, was found between the learning condition and the pre to posttest scores on this factor as well (Figure 5, Table 15).

Work Skills

Questions B (Written directions) and C (Terminology) of this section, as reported earlier, were excluded from any analysis. Posttest statistical analysis ($t = 1.333$, $p>.05$) found no significant differences between the RI group (posttest mean of 14.54) and the FIE group (posttest mean of 14.78 (Table 13). Pre to posttest analysis did not yield significant results with the control group mean improving by .31 and the experimental group increasing its score by 3.22. The two-way analysis of variance did not yield any significant results (Table 16).

Overall Achievement

Once again no significant posttest findings were indicated ($t = 1.0159$, $p>.05$) with a RI posttest mean of 5.23 and an experimental of 6.00 (Table 13). Pre to posttest mean scores were not significantly different for either the control or experimental conditions. The control group mean score increased by .23 while the experimental mean increased by .89. The two-way analysis of variance

TABLE 16

ANOVA for VERS Work Habits Data

Involving 2 (instructional methods)
x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/42	213.284	2.079
Error	42	102.451	
Within			
Methods	1/42	12.375	2.289
Error	42	5.405	
Interaction	1/42	7.102	1.314

TABLE 17

ANOVA for VERS Overall Achievement Data

Involving 2 (instructional methods)
x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/42	12.375	2.704
Error	42	4.576	
Within			
Methods	1/42	1.375	.111
Error	42	12.377	
Interaction	1/42	.2840	.023

TABLE 18

Mean pre and post scores and t-scores for the Socialability with Fellow Students, Attendance, Flexibility, Initiative, Following Oral Directions, Quality and Quality of Work for the VERS

		Scores				t-values		
		Pre		Post		RI and FIE	RI vs FIE	
Area	Cond.	M	s.d.	M	s.d.	Pre-Post	pre	post
SOCIAL-	RI	2.46	.78	2.15	.80	1.8091		
ABILITY	FIE	2.33	1.12	2.11	1.17	1.000	.3013	.0891
ATTEND-	RI	89.44%	11.02	89.48%	13.13	.0107		
ANCE	FIE	2.11	.60	2.67	.71	2.2361	.7531	1.3258
INITIA-	RI	2.31	.95	2.31	.63	0.000		
TIVE	FIE	2.33	1.00	2.78	1.30	1.0776	.0471	1.0059
ORAL	RI	2.46	.66	2.38	.51	.3180		
DIRECTIONS	FIE	1.78	.44	2.44	.53	3.6742**	2.8991*	.2651
QUALITY	RI	2.62	.65	2.77	.60	.6882		
	FIE	2.22	.44	2.78	.83	2.2361	1.7212	.0310
QUANTITY	RI	2.08	.76	2.46	.78	4.0249**		
	FIE	2.11	.60	2.56	1.13	1.3093	.1032	.2302

did not yield any significant results (Table 17).

Isolated Factors

No significant results were obtained for any of the 7 isolated factors when posttest results were compared (Table 18). Pre to posttest comparisons yielded significant differences for the experimental group on the factor measuring Ability to follow oral directions ($t = 3.6742$, $p<.01$) and for the control group on the Quantity of work factor ($t = 4.0249$, $p<.01$). Of the non-significant factors the RI group improved on Attendance, Quality and Quantity of work, stayed the same on Flexibility and Initiative; and did worse on Sociability and Following oral directions. The FIE group on the non-significant factors improved on Flexibility, Initiative, Quality and Quantity of work and did worse on Sociability and Attendance.

Achievement Tests

The results for the WRAT are presented below (Table 19):

1. Spelling - There was no significant posttest difference between the RI and FIE groups ($t = .4565$, $p>.05$). The RI group did not improve significantly pre to post ($t = .0720$, $p>.05$) however the FIE group did ($t = 4.3643$, $p<.01$). The two way analysis of variance did not produce any significant findings (Table 20).

TABLE 19

Mean pre and post grade scores and t-scores for
the Wide Range Achievement Test and Schonell Reading Test (SLR)

						t-values		
	(N)	Pre		Post		RI and FIE	RI vs FIE	
Part	Cond.	M	s.d.	M	s.d.	Pre-Post	pre	post
SP	RI (14)	74.571	11.092	74.429	8.225			
	FIE (10)	71.500	13.810	76.600	13.335	4.3643**	.4972	.4565
AR	RI (13)	68.154	8.688	74.293	7.599	3.4336***		
	FIE (10)	66.800	6.973	77.100	6.983	6.4228***	.4145	.7132
OR	RI (14)	71.643	9.044	79.643	16.556	2.2235**		
	FIE (10)	73.500	16.440	82.400	18.398	3.4677**	.3239	.3772
SLR	RI (14)	2.73	.80	3.19	1.06	2.7307*		
	FIE (9)	2.40	1.02	2.88	1.28	2.8893*	.8616	.6116

(SP = Spelling; AR = Arithmetic; and OR = Oral Reading)

* p <.05
** p <.01
*** p <.001

TABLE 20

ANOVA for WRAT Spelling Results

Involving 2 (instructional methods)

x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/46	3812.760	1.308
Error	46	2915.210	
Within			
Methods	1/46	25.010	2.323
Error	46	10.766	
Interaction	1/46	29.260	2.718

2. Arithmetic - No significant findings were obtained from the posttest analysis ($t = .7132$, $p>.05$) of the mean standard scores. Both conditions did demonstrate significant gains pre to post (RI, $t = 3.4336$, $p<.01$; FIE, $t = 6.4228$, $p<.001$). The two-way analysis of variance found a significant main effect for the instructional methods, $F_{(1,44)} = 20.1350$, $p<.01$ (Figure 6, Table 21).

3) Oral reading - Significant posttest results were not found on this area of the WRAT ($t = .3772$, $p>.05$). Pre to posttest comparisons yielded significant results for the RI group ($t = 2.2235$, $p<.05$) and the FIE group ($t = 3.4677$, $p<.01$). The two-way analysis of variance also found a significant main effect for instructional methods, $F_{(1,46)} = 10.3293$, $p<.01$ (Figure 7, Table 22).

4) Schonell Reading Test - As in all the other achievement areas reported above, no significant posttest findings were yielded ($t = .6116$, $p>.05$). The pre to posttest analysis found significant gains for the RI group ($t = 2.7307$, $p<.05$) and for the FIE group ($t = 2.8892$, $p<.05$). The two-way analysis of variance yielded a significant main effect for instructional methods, $F_{(1,46)} = 10.2832$, $p<.01$ (Figure 8, Table 23).

TABLE 21

ANOVA for WRAT Arithmetic Scores

Involving 2 (instructional methods)
x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/46	1926.533	.7158
Error	46	2691.162	
Within			
Methods	1/46	396.533	20.135**
Error	46	19.684	.124
Interaction	1/46	2.446	

**p<.01

Figure 6. Mean scores obtained at pre and posttesting for the Arithmetic subtest of the WRAT with the two instructional methods (FIE and RI).

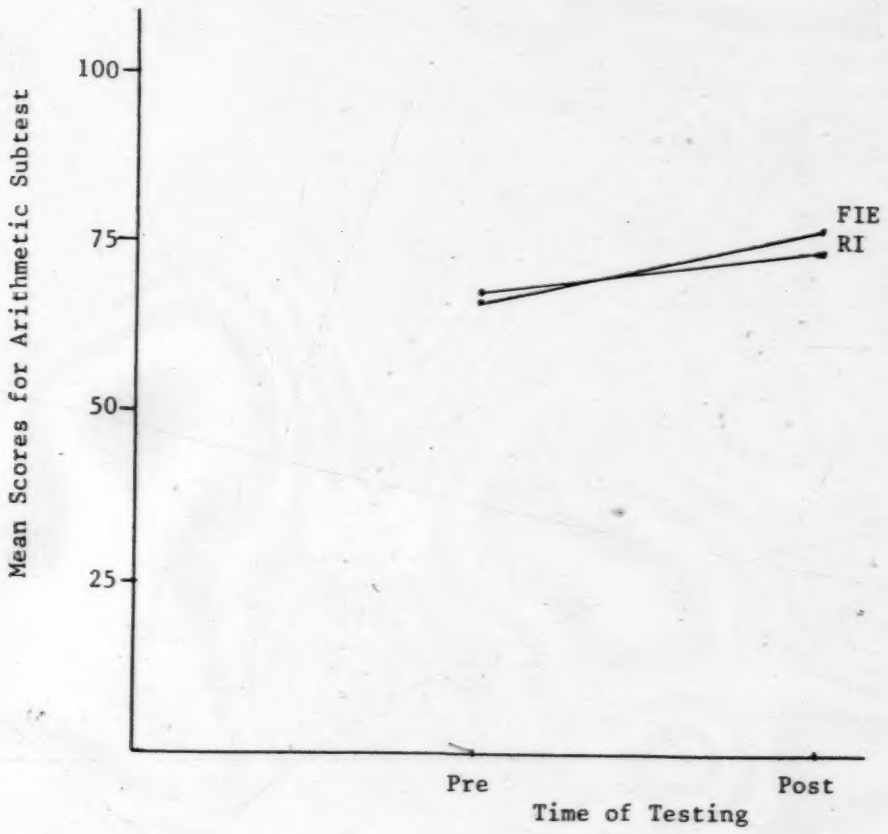


TABLE 22

ANOVA for WRAT Reading Scores

Involving 2 (instructional methods)

x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/46	3255.010	1.024
Error	46	3180.277	
Within			
Methods	1/46	420.844	10.329**
Error	46	40.742	
Interaction	1/46	5.510	.1352

**p<.01

Figure 7. Mean scores obtained at pre and posttesting for the Reading subtest of the WRAT with the two instructional methods (FIE and RI).

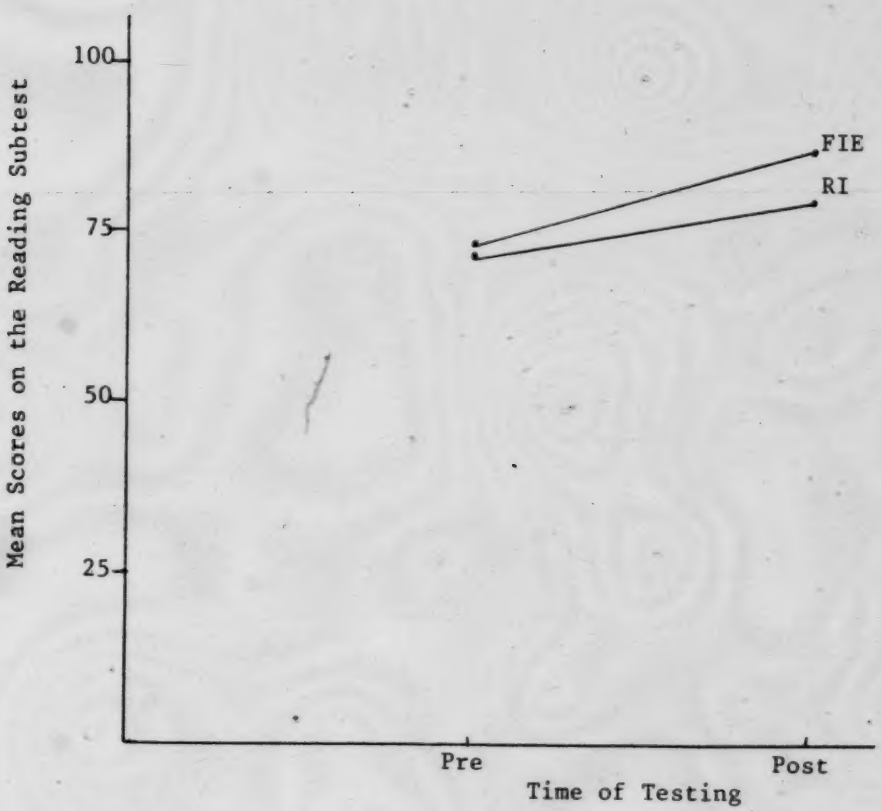


TABLE 23

ANOVA for Schonell Silent Reading Scores

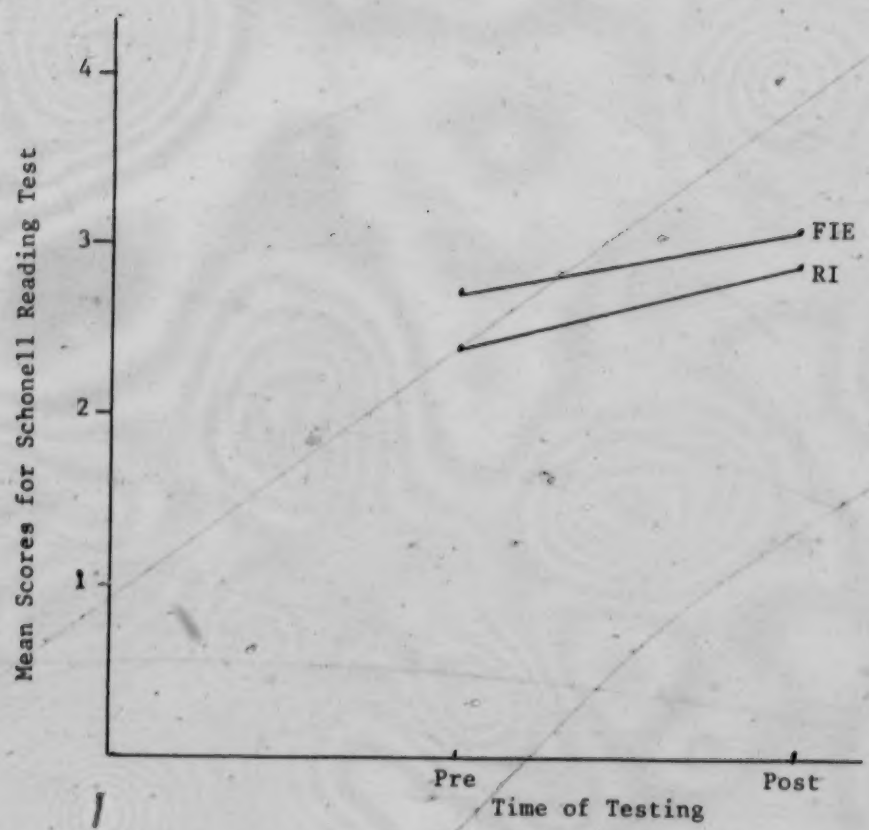
Involving 2 (instructional methods)

x 2 (pre and posttest measures)

Source	df	MS	F
Between			
Measures	1/46	18.027	3.813
Error	46	4.728	
Within			
Methods	1/46	1.402	10.283**
Error	46	.060	
Interaction	1/46	.136	.441

**p<.01

Figure 8. Mean scores obtained at pre and posttesting for Schonell Reading Test with the two instructional methods (FIE and RI).



CHAPTER VI

DISCUSSION

The results did not support any of the stated hypotheses concerning the expected effect of FIE on vocational performance. The overall lack of significant findings will be discussed below. Results are reviewed in relation to the specific areas under study. Conclusions and implications for future study will be discussed in subsequent chapters.

Vocational Task

Error detection

The Organization of Dots instrument contains a series of pages constructed with intentional errors that the student is required to detect. Feuerstein (1980) states that this portion of the instrument develops "a conscious critical approach" which the student is then able to generalize to other work. Feuerstein (1980) further states that practice on the instrument results in a decrease in the number of errors produced in determining the correct solution. No research evidence is provided to support this stated effect of FIE.

Error detection, whether the errors are self or externally generated, is seen as a necessary component of critical thinking by Deshler, Ferrell and Kass (1978) and

Schumaker et al. (1981). These authors contend that error detection skills result in less errors and more efficient production as the individual is able to review and correct his/her own work. Using a direct instruction format with cognitive components such as verbal rehearsal, the authors (Deshler et al., 1978; Schumaker et al., 1981) were able to teach students with learning disabilities to improve their own error detection skills, although no testing for generalization from the resource room to the regular classroom was conducted. This procedure has yet to be applied to students with a developmental delay.

The design of the error detection task of this study was constructed in consideration of some of the specific goals of the Organization of Dots instrument. However, the findings of the postest analysis did not support hypothesis 1 or 1.1. No significant difference was found for the FIE group in comparison to the RI group's ability to correctly identify errors. In fact the RI group improved more significantly pre to post than the FIE group on diagram 4 and the total error score. No significant differences were found pre to post on any of the other diagrams. Given that the improvement only occurred on one diagram, that this accounts for the significant findings of the total score analysis, and that both conditions improved, it is logical to assume that the results may simply be an artifact of the design of this one diagram.

Descriptive discrimination

Commensurate with the detection of errors in the Organization of Dots instrument is the correlated task of describing the types of errors. Within the instrument itself a key is provided of the different types of errors and the student is to indicate by checking the appropriate element in the key, the type of error present. Feuerstein (1980) writes that by learning to describe the type of error the student will be able to anticipate and avoid possible errors. No studies have been reported which measure this stated effect of FIE. In addition to the paper and pencil portion of the task the teacher of FIE is to elicit from the students verbal descriptions of errors, along various dimensions, and their occurence in real life situations (Feuerstein and Hoffman, 1981).

In this study subjects had to describe how a particular circuit was the same or different from the corresponding diagram (e.g., the circuit is square and the diagram is round). No significant posttest differences were found in comparing the two groups. The RI group did improve significantly pre to post while the FIE group did not. This maybe partially explained by the lower score of the RI group to begin with, improving to the same point on the posttest as where the FIE was on the pretest. The FIE group, scoring high to begin with, may have been affected by a ceiling effect.

Circuit board construction

This aspect of the Vocational Task was designed not only for its functionality but its potential sensitivity to the learning that is supposed to be derived from both Organization of Dots and Orientation in Space I. Feuerstein (1980) states that these instruments improve such cognitive functions as conservation of constancy, visual transport, planning, comparative behavior, localization of objects in space and in relation to one another. Functions which are easily seen as important to the accurate construction of duplicate circuit boards. No research has been reported which demonstrates the effect of FIE on any specific vocational task or any of the cognitive functions stated above.

This task was felt to be within an acceptable range of difficulty given numerous studies demonstrating the capacity of individuals with even severe developmental delays to learn to produce complex vocational assemblies (Wehman, 1981; Gold, 1980). This task requires an ability to utilize the strategy of match to sample with careful attention to descriminative stimuli. The literature is replete with successful examples of "match to sample" formats used in vocational task training (Mithaug, 1981; Gold 1980; Bellamy, Horner and Inman, 1979).

Further, in a number of instances these tasks have included circuit board construction (Levy, et al., 1977).

However, while these direct teaching studies have proven potential it is difficult to draw comparisons between the studies give the different descriminative stimuli used (i.e., complexity, shape or type).

In this part of the study all subjects failed to evidence significant improvement either between or within groups. It would appear that the same skills necessary to complete the two FIE Instruments did not generalize to a functional vocational task. Significant favourable differences would have been evidence for far generalization.

Feuerstein (1980) states that FIE places a greater emphasis on precision in consideration of speed. This may be conceived as due to the stated aims of FIE to reduce impulsivity, foster precision and accuracy, develop reflective and insightful processes, gathering all information and self-monitoring of performance (Feuerstein, 1980). However, Feuerstein (1980) reports on the results of the Lahy test of rapidity-precision complex (Zazzo, 1964) which did not yield complete support of precision first, rapidity second. He does state the FIE group had a higher proportion of correct and lower proportion of incorrect responses than the control group.

The hypothesis of increased time to completion for the FIE group was based on the above stated goals and

the task design. Exact replication of the model board requires precision through time consuming strategies (i.e., measuring or counting spaces for exact placement of properly matched circuits). The hypothesis regarding time was not substantiated due to the lack of any significant findings. When viewed in conjunction with the lack of significant results concerning accurate construction one would expect little evidence of time consuming strategies that facilitate accuracy.

Overt strategies

The design of the Vocational Task lends itself to the likely occurrance of overt tactics in completing the circuit boards. The most precise way to build a duplicate board is to count the spaces or measure the distance between circuits and between the circuits and the borders of the board. This would probably be accompanied by a repeated measure to check for accuracy and a repositioning of circuits if necessary. Other strategies that might be evidenced include counting the number of circuits and placing one circuit directly against another for accurate comparison. An obvious shortcoming of the design is that most if not all of the strategies could be effectively utilized covertly. The results must therefore be reviewed with some tentativeness.

Feuerstein (1980) suggests that FIE results in the development of problem solving strategies and it would therefore seem logical to envision the greater utilzation by the FIE group of overt problem solving strategies. Once again no significant results were obtained either on the posttest comparison or pre to post analysis. This lack of evidence regarding strategies would seem to coincide with the lack of significant findings in accurate board construction and longer time. Correct board duplication necessitates the effective use of problem solving strategies, which with this task, results in a longer time for completion.

Vocational Evaluation Rating Scale (VERS)

Feuerstein (1980) reports that FIE has a large number of positive effects on general social and school behaviors (Appendix A). Some evidence is presented to support these behavioral outcomes. Feuerstein (1980) reports some support in favour of general behavioral effects based on the results of the Classroom Participation Scale (Tannebaum and Levine, 1968) administered after the completion of an FIE program. The scale is divided into two parts, CPSI and CPSII. CPS I is described as a checklist of desirable and undesirable classroom behaviors. No significant findings were yielded on CPS I. The CPS II is described as consisting of single-sentence descriptions

of classroom habits that are considered adaptive or non-adaptive. On this measure significant findings were found in favour of FIE on three factors - interpersonal conduct, self-sufficiency and adaptiveness to work demands. Some additional information is provided noting that starting and finishing work independently and task persistence were part of the self-sufficiency factor. The adaptiveness factor was described as including the prosocial behaviors of helping others and sharing materials safely.

The importance of general social and work behaviors has been noted in the literature on the vocational training of people with a developmental delay (Rusch, 1979). In some instances social skills in the work place have been deemed to be as or more critical than specific job skills in retaining employment (Johnson and Mithaug, 1978). Social skill training has been successfully demonstrated with the population under study (Renzaglia and Bates, 1983).

In this study no significant results were found in the posttest analysis of all the measures employed. A significant effect was found for the Personal and Social Qualities and Work Habits areas of the VERS. On Work Skills and one item from this area, Following oral directions, the FIE group scored significantly lower on the pretest than the RI group. In both instances the FIE group

improved on a raw score basis to a higher score than the RI group on the posttest, however the pre to post difference was only significant on the Following oral directions item. On Work Habits the FIE group did improve significantly pre to post while the RI group improved significantly only on the Quantity of work item. While these findings do not demonstrate clear support of one method over the other in any general sense, some support for FIE is indicated. The FIE group did account for the only significant pre to post gain and this was in an area of some importance to vocational success, Work Habits. The few significant findings are two limited for adequate conclusions, but are discussed further in the next chapter.

This particular assessment device poses some dilemmas in analysis due to its subjectivity, lack of administration guidelines, pre and post application by different teachers after students have spent time in vocational classes that also differed pre to post.

Achievement Testing

This is the one hypothesis that was substantiated as it was derived from previously reported research on FIE and achievement testing. In the previously reported study (Feuerstein, 1980) reports that FIE subjects demonstrated significant posttest results over the control group on 2 out of 12 achievement tested areas, bible and geometry.

These results are interpreted as supportive of FIE given that control group subjects demonstrated no significant posttest results, had a content loaded, as opposed to content free curriculum and that the FIE students spent less time in the content subject areas. Haywood and Arbitman-Smith (1981) stated that they did not expect any achievement findings given Feuerstein's results, until one to two years after the completion of their study. Haywood and Arbitman-Smith (1981) have included the WRAT in their study but have not yet reported any results.

In this study no significant posttest findings were found in favour of either group on the three WRAT areas and the Schonell. Both groups significantly improved pre to post in almost all cases. Only the RI group failed to demonstrate significant gains on spelling. These results at least suggest that the FIE students have not been adversely affected by the loss of time and instruction in school content areas.

Feuerstein's (1980) limited results create some confusion, as one would expect, as Haywood and Arbitman-Smith (1981) do, that FIE effects would be demonstrated in content area gains. The development and enhancement of learning potential could logically be expected to be demonstrated in curriculum areas.

Experimental support for what should have been the hypothesis, that FIE would significantly affect achievement

scores, remains to be demonstrated. The substantion of this study's hypothesis must not be interpreted as positive but as contrary to what truly should be expected.

CHAPTER VII

CONCLUSIONS

This study on FIE attempted to address a number of major concerns expressed in the literature regarding the very limited amount and type of research conducted to date on this method. There is general agreement in the literature that students with a mild developmental delay should be taught intellectual skills and strategies that promote generalization and learning in out-of-school environments. FIE is described by its author as one of the methods that can accomplish this goal (Feuerstein, 1980). In this study subjects who received FIE and the regular curriculum were assessed on a functional vocational task, general vocational behavior in vocational classes and achievement tests. The primary purpose being to determine if FIE instruction resulted in a demonstrably greater ability for students with a mild developmental delay to solve a vocational problem than students who did not receive FIE. No significant results were found in the posttest analysis on any of the measures. These findings necessitate thoughtful and careful analysis. The limitations of this study aside (Chapter VIII), the findings raise some critical questions, particularly in regard to the apparent rapidly growing popularity and implementation of a yet to be substantiated method.

The divergent effects hypothesis raises a number of

concerns in general and in particular for the cooperating vocational high school. When a methodology such as FIE which requires a two year wait or longer to determine its effectiveness, is suggested for a population which typically requires a long and intense instructional process, a great deal of caution must be exercised in its implementation. Students with a developmental delay may not be able to afford to wait the necessary years, particularly when no evidence yet exists for this population andon measures that are critical for functional success (i.e., natural community environments and tasks). At the cooperating vocational high school the time element is further complicated by the slow pace of implementation, currently half the recommended rate. Add to this the lack of preliminary supportive evidence from this study or from Haywood and Arbitman-Smith (1981) with this population. These considerations suggest that the utilization of FIE should: a) not be expanded until initial studies underway are completed; b) have provision for compensatory education if positive results are not forthcoming; and c) include measures on a variety of ecologically valid tasks.

The divergent effects hypothesis must be viewed with some tentativeness given the very limited experimental support available at this time. In any long term educational approach one necessarily and logically expects to see progressive improvement over time. As noted

previously in this paper, improved ability does not manifest itself magically but rather gradually. The divergent effects hypothesis may be used to account for the continued improvement after the cessation of a FIE program. It should not be construed as suggesting that the lack of progressive change over the course of a FIE program is acceptable. In the utilization of any long term educational approach the failure to demonstrate progressive improvement during the course of intervention would result in the cessation of the method, its alteration, or its enhancement by the addition of other methods. The vocational task was designed for this study to be sensitive to possible FIE effects, so that if generalization was present it would be likely to be demonstrated. Although only two instruments were used the skills required for the instruments and the vocational task are highly similar. The two instruments were completed without any noticable impact. These two instruments were administered three to four days per week by trained staff, much as any other curricular material is presented. If a math program failed to demonstrate positive results after a year of implementation serious reservations would be expressed about its effectiveness. The same is true for FIE as considered in this study.

Campione, Brown and Ferrara (1982) state that while in agreement with Feuerstein's (1979; 1980) philosophy they

question the methodology of FIE. In essense FIE has the student complete paper and pencil content free (i.e., irrelevant material to everyday functioning) tasks, which are then discussed verbally in classroom settings in terms of how the general principles apply to everyday life and students are then expected to demonstrate generalization perhaps years later. This construct is analagous to the "train and hope" method of generalization (Stokes and Baer, 1977) and contrary to the state of the art knowledge of direct instruction in generalization training. Given the fact that if anything, the population of individuals with a mild developmental delay are characterized by their difficulty to generalize, the FIE approach as currently structured is highly questionable. Comparable perhaps to other initially popular and later disproved special education approaches that postulated theoretical prerequisites to functional skills (e.g., training in perceptual motor skills would overcome reading difficulties). The elements of teaching within FIE, having students think and relate to everyday life events are simply components of good teaching which should be present in most educational contexts. It is the construct of meaningless paper and pencil exercises producing generalizable practical applications for a population that has difficulty generalizing from one environment to another that must be addressed. This author agrees with the

general position of Campione, Brown and Ferrara (1982), Brown, Branston, Hamre-Nietupski, Pumpian, Certo and Gruenwald, (1979) and Borkowski and Cavanaugh (1979) that essentially support direct instruction in thinking and functional skills in natural, meaningful environments. As closely as possible training environments and materials should approximate the natural environment to enhance the possibility of generalization. Further there must be direct and supported practice in the natural environment concurrent with instruction that incorporates state of the art knowledge (i.e., direct instruction, self-management skills and generalization strategies).

The curriculum must acknowledge individual student needs and abilities thereby providing meaningful curricular goals and instructional methods. The dilemna for teachers is that FIE presents a prepackaged approach to instruction which teachers may not know how to evaluate, and as such is perhaps too readily available for use. Other methods, while supported by research, require the teacher to establish the program. Even while difficulties remain establishing generalization the methods do exist for teaching through direct instruction the skills that students with a mild developmental delay need to learn.

This study raises concerns beyond FIE itself. The regular curriculum and instructional processes at the cooperating vocational high school resulted in extremely limited significant pre to post improvement in the area of

vocational performance. Academic performance did improve pre to post in both conditions as measured by standardized achievement testing. However, these results cannot be generalized to the utilization of functional academics on out-of-school tasks. These findings raise questions about the regular program, which should not require years to demonstrate generalization on a task directly related to the intended purpose of the curriculum. Comparing FIE to regular instructional methods, as done here and in other studies, is a comparison of very limited utility. FIE needs to be used in comparison to state of the art instructional methods.

A number of factors may help to further explain the negative findings. Feuerstein et al. (1981) and Brown, Branston, Hamre-Nietupski, Johnson, Wilcox and Gruenewald, (1979) have argued in favour of heterogenous groupings to enhance learning and development. The cooperating vocational high school provides a segregated setting for approximately 400 students with a mild developmental delay. This context inhibits learning appropriate social behaviors due to the lack of non-handicapped peer models and inhibits generalization given the lack of non-handicapped peers demonstrating and supporting thinking skills. The more abnormalizing the training environment the less likely the occurrance of generalization. The natural environment to which these students return daily and upon the completion

of schooling, is integrated. It follows that the training environment should be similar. While Feuerstein (1980) states that FIE may be applied to "culturally deprived" students regardless of individual needs, this may be an issue for this population. Besides being contrary to the recent emphasis on individual educational planning not all students may need or benefit from FIE. The utilization of FIE on an individual remedial basis even in conjunction with the Learning Potential Assessment Device (LPAD) has yet to be reported. Specific criteria appears to be lacking as to when a student has successfully completed an instrument. Levels of assistance required to complete the instrument may have varied considerably but this variation is impossible to account for. These latter points are evidence of some additional methodological problems in using FIE.

Another factor in the use of FIE relates to the specific vocational high school that cooperated in this study. This school is under a certain amount of pressure given a decline of enrollment due to the increasing trend towards integration. As such the school has lowered over time its entrance age and in addition may be viewing a high profile program like FIE as a means to attract students. Although Feuerstein, et al. (1981), has advocated heterogenous groupings, the school may view FIE's claimed power as a means to overcome the effect of the segregated

environment both emotionally and intellectually upon the students. It has already expanded its FIE program without any consideration of the results of this or any other study. FIE is a highly attractive method as it requires limited teacher training, is prepackaged and claims to do all the right things almost regardless of the problem. The staff at the school, without any data, clearly believe FIE is having an impact and remark upon the generally improved behavior of the FIE students in comparison to the non-FIE students. This potentially self-fulfilling prophecy may be in evidence in the subjective measures of the Vocational Evaluation Rating scale given that the only exclusively positive effect of FIE was detected on some portions of this measurement device.

In summary, while the results must be viewed with some tentativeness given the limited passage of time and number of FIE instruments completed, sufficient cause for caution has been demonstrated for the population under study. In essence, two highly questionable practices have been combined, teaching in a segregated environment and using content-free paper and pencil exercises with the hope that the result will be generalizable intellectual skills and strategies. Further studies must ensure comparison of FIE to high intensity relevant instructional processes preferably in integrated settings and on ecologically valid tasks in natural (i.e., out-of-school) environments.

CHAPTER VIII

LIMITATIONS OF THE PRESENT STUDY AND IMPLICATIONS FOR FUTURE RESEARCH

A critical appraisal of this study indicates a number of limitations. The sample population, which was of limited size to begin with due to the logistical demands of the vocational testing procedure, was further reduced by the removal of one experimental class (4 subjects). This was necessitated by the failure of this class to complete any of the FIE instruments as the teacher was not able to spend the necessary time on FIE. Another feature of the study population was their young adolescent age. The young age may account for the lack of significant vocational outcomes. It is unclear whether chronologically age matched non-handicapped peers would perform well on the vocational task components. An obvious limitation was the pace of the two remaining experimental classes in only completing two instruments when at least four were expected to be completed. This is offset by the experimental task which was designed to tap the same cognitive abilities required for Organization of Dots and Orientation in Space I. The actual design sensitivity may be questioned but the functionality, as a critical component, remains. A possible limitation may have been the lack of an outside advisor for the teachers as recommended by Feuerstein (1980) at least for the first year of FIE. One of the

teachers in this study had completed level two training for teachers of FIE but was only able to act as an advisor to the other level one teachers in a limited way. It was the intention of this study to directly observe FIE and non-FIE teachers in the classrooms. Teaching style and technique differences were to be analysed between FIE and non-FIE teachers. Unfortunately, the teaching staff were not receptive to direct classroom observation and eventually rejected this component.

The limited time span between the pre and posttesting may account for, although to an unknown extent, the lack of a large number of pre to post significant improvements for either condition in the vocational areas. However, the expectation of improvement in such a critical curricular area would not be unreasonable over a time span of more than half the school year. Achievement scores did improve over the same time period which suggests some basic academics were being learned. The time span limitation should not have effected the posttest analysis, particularly as FIE was started prior to the pretesting. The implications of the divergent effects hypothesis were discussed in the preceeding chapter.

Measures of possible I.Q. improvement pre to post could have provided useful information. If the results would have been positive for FIE one could conclude that FIE in this study had similar effects to those demonstrated

by Feuerstein (1980). With non-significant FIE effects on the functional task and in the vocational areas more definitive conclusions could have been drawn. Perhaps FIE has an impact on intellective measures but not in their actual functional implementation. This limitation could be accommodated by assessing the I.Q. of all the subjects as soon as possible or at least at the conclusion of the current long term study. It would probably be useful as well to have chronologically age matched peers without a developmental delay, attempt the vocational task, this would help to determine the effect of age, if any, on the outcomes.

A number of implications for future research on FIE have arisen as a result of this study. At least two of these implications are perhaps a result of general research limitations on FIE to date. Future research must ensure that the effects of FIE must be assessed on critical out-of-school tasks, which until this study, has not been the case. In addition FIE as an instructional method must be compared to other programs that also attempt to teach cognitive strategies and thinking skills, possibly as suggested by Borkowski and Cavanaugh (1979), Campione, Brown and Ferrara (1982). Comparison to regular "special education" programs whose utility is unproven is not nearly as beneficial as a research strategy.

Other implications include utilizing FIE on an

individual basis as indicated by the results of an LPAD assessment. Control students with similar LPAD results could be taught by differing methods. Certain ethical guidelines should be in place when basically untried long term experimental methods are used and more so if they necessitate foregoing an approved curriculum. Future research with FIE should include compensatory educational opportunities if subjects fail to benefit. FIE should be tested in an integrated setting where interactions between peers who are delayed and not delayed may provide mediated learning experiences. This could be expanded by incorporating parent training as an adjunct to the FIE classroom based instruments. The research parameters should be further enhanced by combining FIE with other methods. For example, actual practice in natural environments of functional thinking skills. The comparison could be no FIE, FIE with other methods and FIE alone.

Implications for the current long term study include an intellectual assessment as suggested previously and assessment of non-handicapped peers on the same vocational tasks. Utilization of the functional vocational task should continue with consideration of additional functional skills within the vocational and other domains (e.g., a domestic skill, or a community living skill).

This study, with its incorporation of a functional task component raised a number of critical questions and

concerns which remain to be answered by future research considerations. Future research must take the examined issues into account. Without comparisons to quality instructional processes and on functionally valid skills in natural environments, future results will remain questionable.

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Appendix A: Characteristics of FIE

Feuerstein, R. in collaboration with Rand, Y., Hoffman, M. B., & Miller, R. (1980). Instrumental Enrichment: An Intervention Program for Cognitive Modifiability. Baltimore: University Park Press.

Appendix B

VOCATIONAL TASK

Diagrams for Error Detection and Descriptive Discrimination

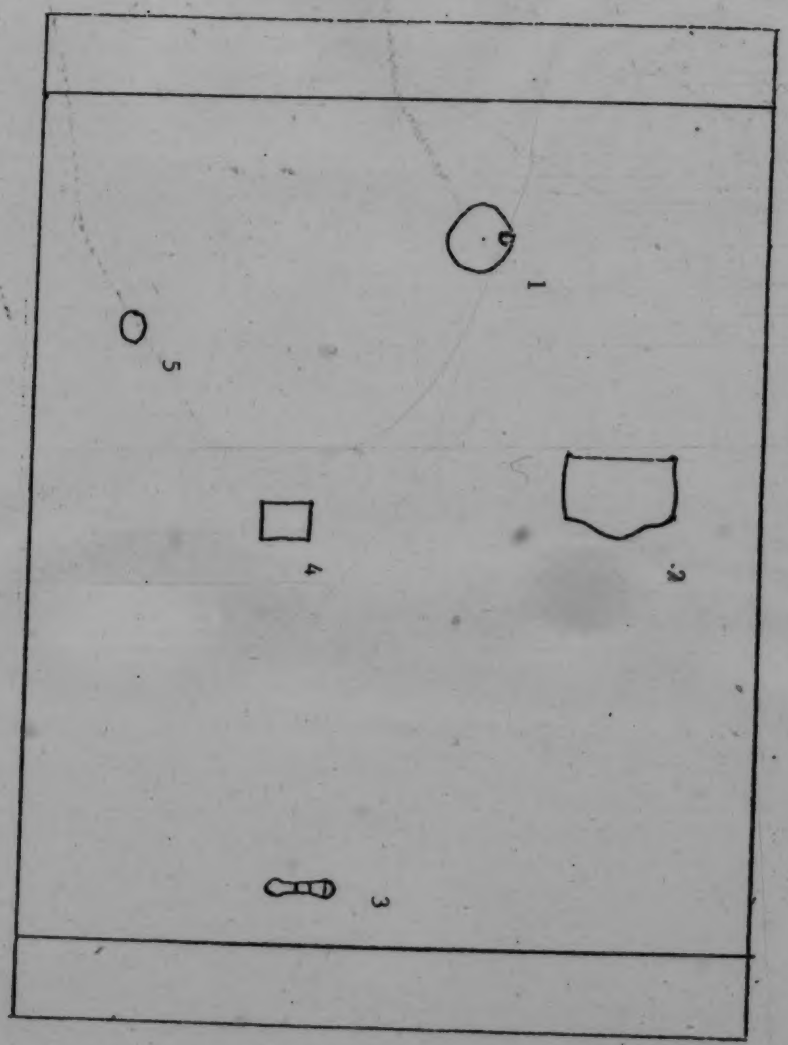
and

Pictures of circuit boards for Circuit Board Construction and Overt Strategies

Developed by B. Uditsky, 1983.

Vocational Task

Error Detection



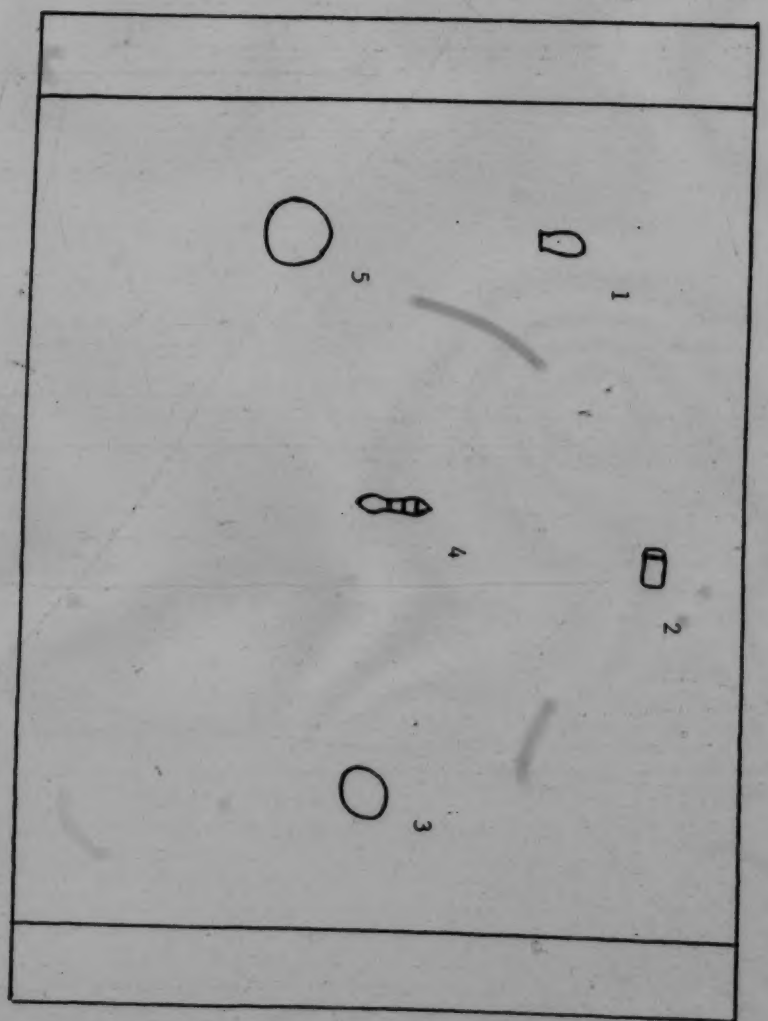
Teaching Diagram 1 Pretest

Drawn correctly
2 and 4.

Drawn incorrectly
1,3 and 5.

Vocational Task

Error Detection



Teaching Diagram 1 Posttest

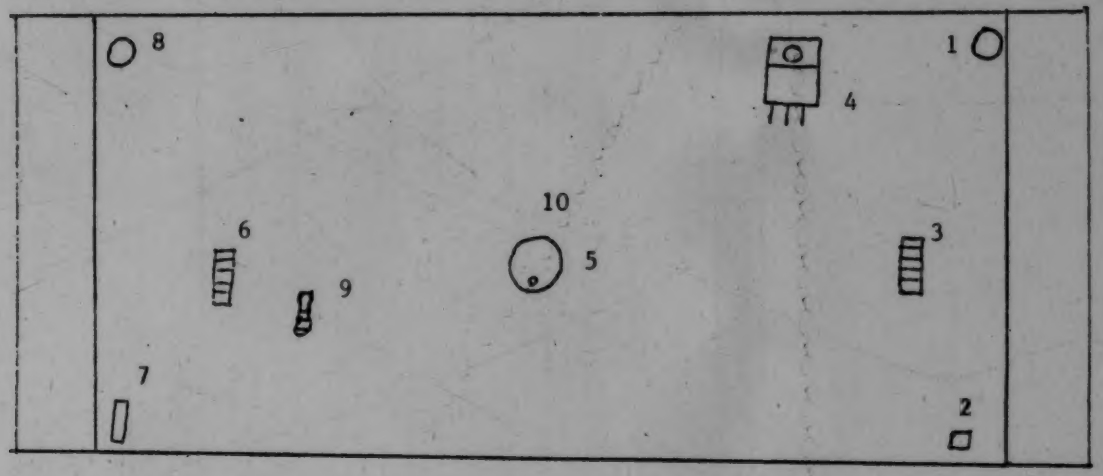
Drawn correctly
1 and 2.

Drawn incorrectly
3,4 and 5.

Vocational Task

Error Detection

Diagram 2 Pretest



Drawn correctly
1, 3, 4, 6 and 8

Drawn incorrectly
2, 5, 7 and 9

Missing
10

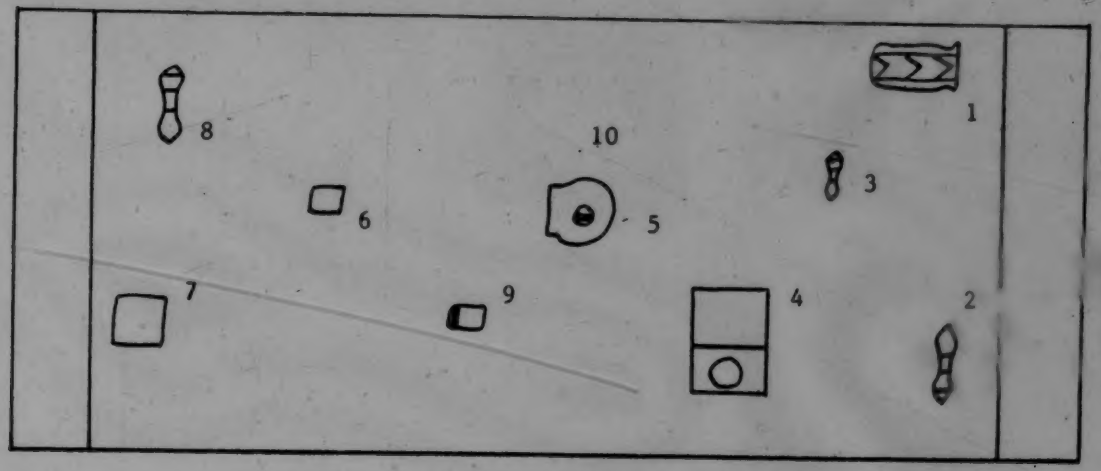
Descriptive Descrimination

Circuit 1

Vocational Task

Error Detection

Diagram 2 Posttest



Drawn correctly
2, 4, 5, 7 and 9

Drawn incorrectly
3, 6 and 8

Missing
10

Descriptive Descrimination

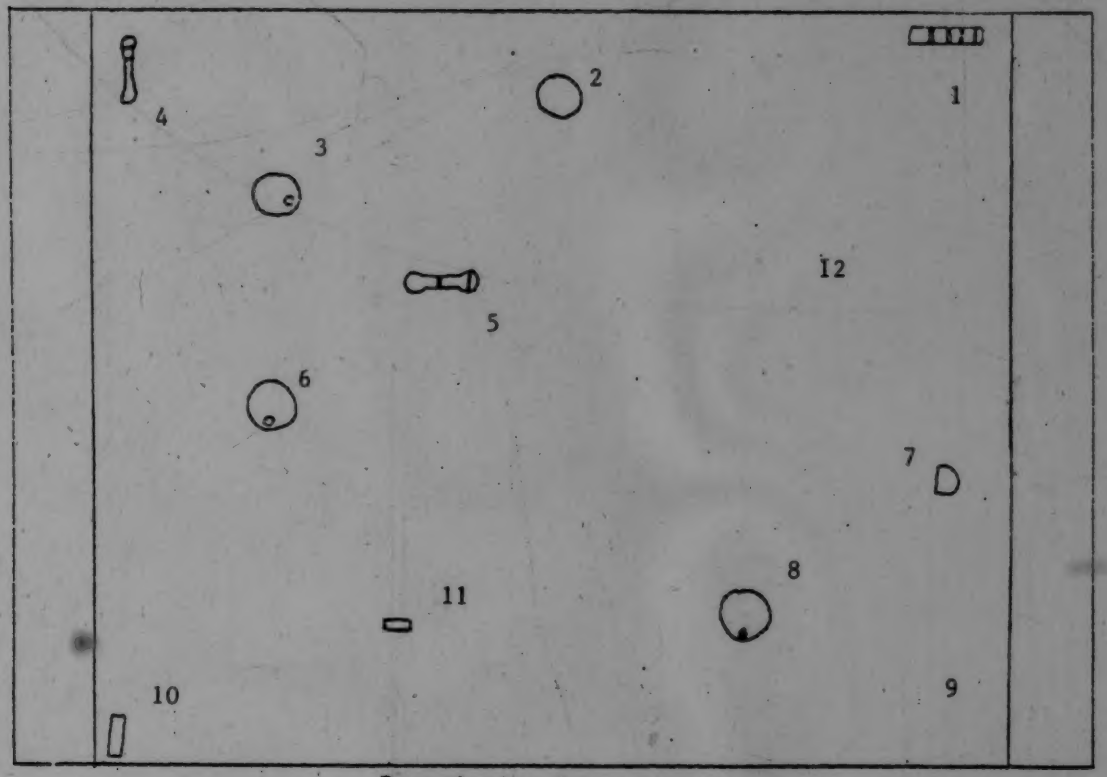
Circuit 1

Diagram 3 Pre and Posttest

Drawn correctly
2 and 3

Drawn incorrectly
1, 4, 5, 6, 7, 8,
10 and 11

Missing
9 and 12



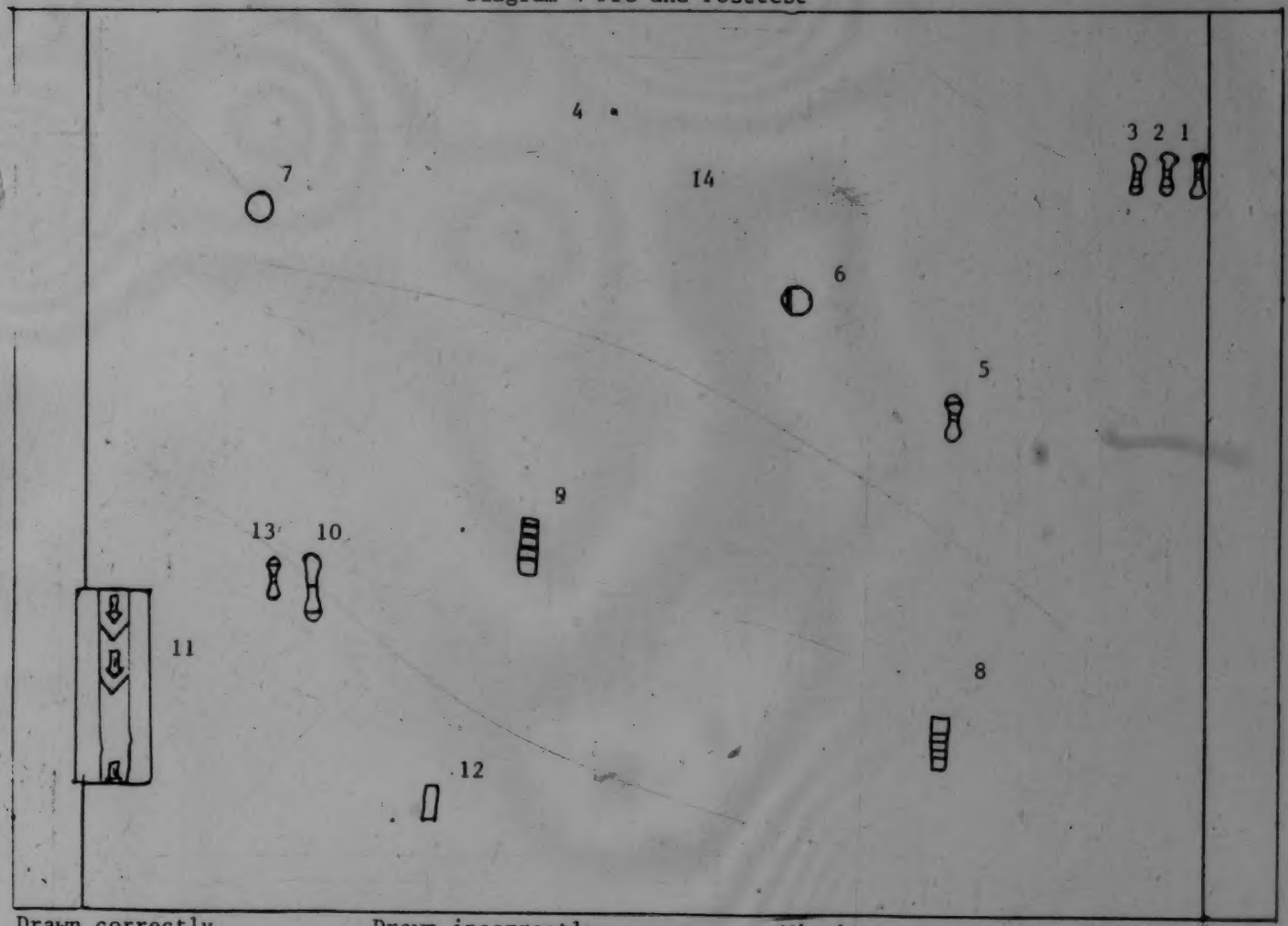
Vocational Task

Error Detection

Descriptive Descrimination

Circuit 5

Diagram 4 Pre and Posttest



Drawn correctly
2, 5, 7, 12 and 13

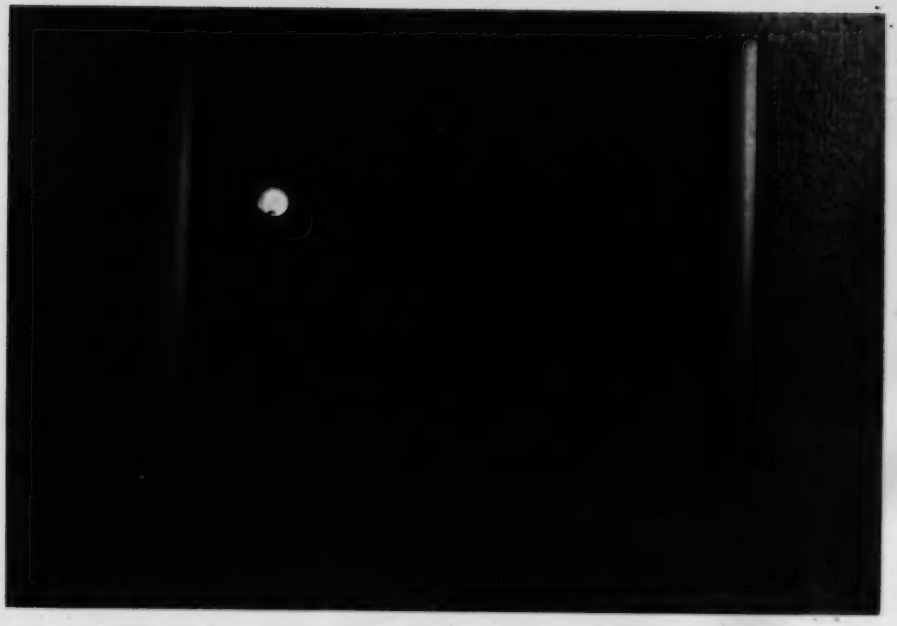
Drawn incorrectly
1, 3, 6, 8, 9, 10 and 11

Missing
4 and 14

Descriptive Discrimination
Circuit 6

Circuit Board 1

Pretest

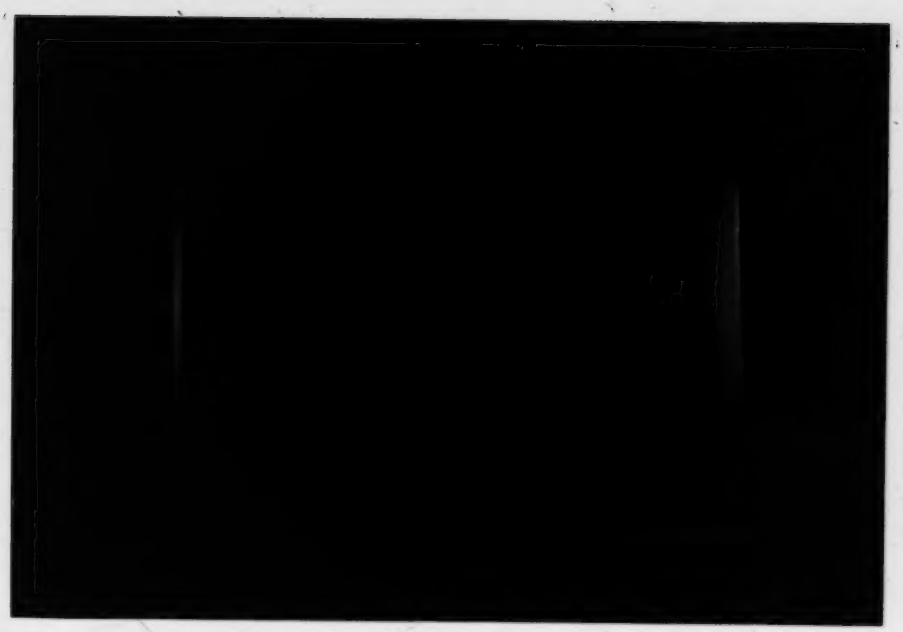


Circuit Board 1

Posttest

Circuit Board 2

Pretest

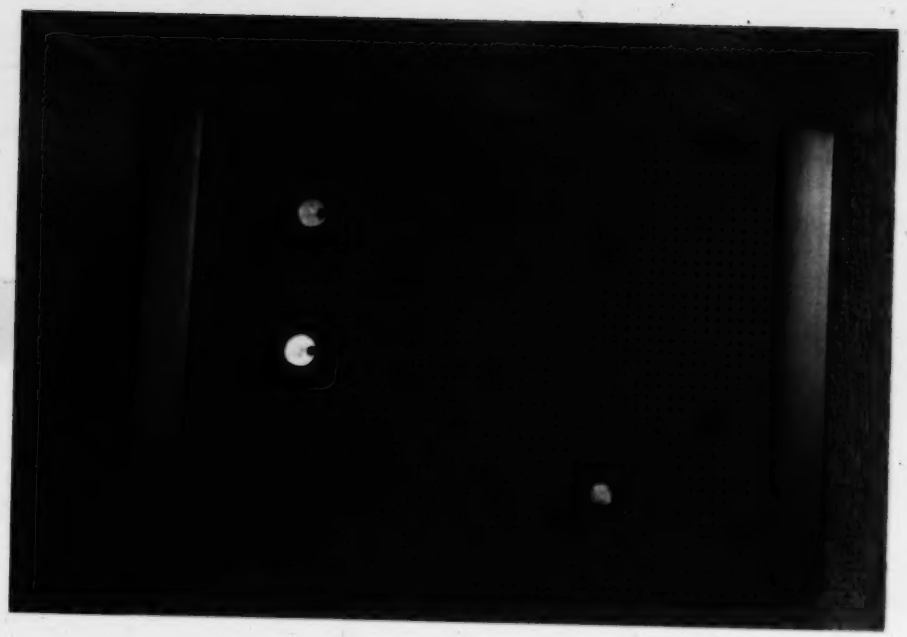


Circuit Board 2

Posttest

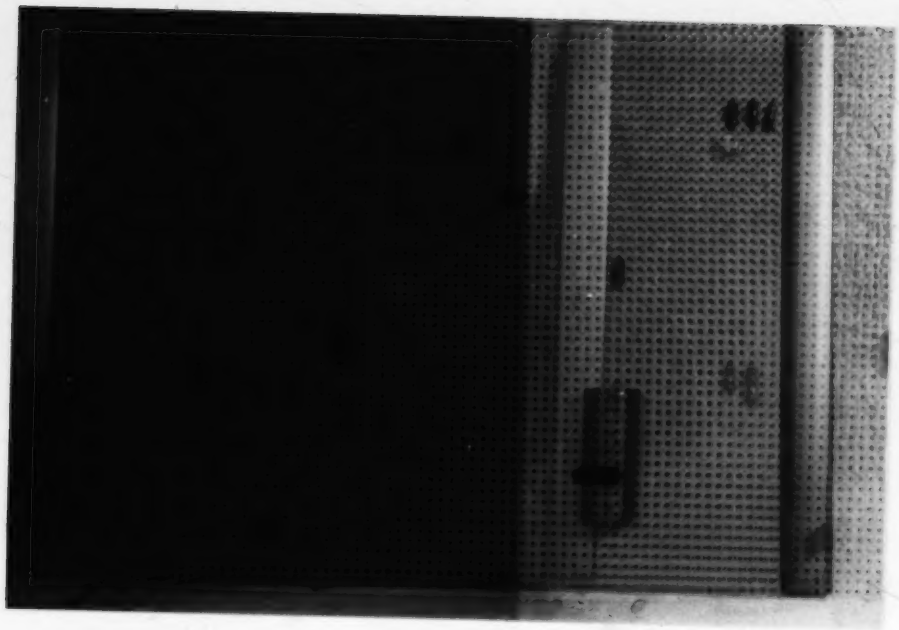
Circuit Board 3

Pre and Posttest



Circuit Board 4

Pre and Posttest



Appendix C

FIE Cognitive Skills Relevant to the Vocational Task

i) Visual transport - "proper scanning process, focussing on the model figure and transporting its image visually to the field where it must be overlapped, compared and judged as to the degree of its appropriateness to the given model"

ii) Conservation of constancy - "to seek the constancy of perceived objects above and beyond variations in certain of their particular characteristics"

iii) Precision and accuracy - "to accurately identify dimensions"

iv) Planning and restraint of impulsivity - planning actions to minimize or negate errors

v) Discrimination - "the capacity to withstand and resist the seduction of an element that seems, at first, to respond closely to the established criteria"

vi) Segregation of proximal elements - to segregate elements that are very close to each other.

vii) Summative behavior - totalling the components of the task

viii) Comparison and perception - determination of whether or not elements are identical.

ix) Judgement of similarity - "the judgemental process of evaluation of...similar or dissimilar"

x) Orientation in space - representational space perception.

Appendix D

VOCATIONAL EVALUATION

STUDENT _____ HOME ROOM _____ VOCATIONAL AREA _____

TEACHER _____ DATE _____

RATING SCALE 4-Excellent 3-Very Good 2-Satisfactory 1-Improvement Possible X-Unable to perform

PERSONAL AND SOCIAL QUALITIES

A) Sociability (1) ability to get along with fellow students	4	3	2	1
(2) ability to get along with teacher	4	3	2	1
B) Honesty and Trustworthiness	4	3	2	1
C) Appropriate attire for the area	4	3	2	1
D) Hygiene - neat and clean	4	3	2	1
E) Courteous and polite	4	3	2	1
F) Shows self control - ability to control emotions	4	3	2	1
G) Conscientious - Personal application to assigned work	4	3	2	1

WORK HABITS

A) Attendance - _____days present out of _____days	4	3	2	1
B) Notifies school if planning to be absent	4	3	2	1
C) Punctuality	4	3	2	1
D) Safety conscious	4	3	2	1
E) Acts upon advice and constructive criticism	4	3	2	1
F) Completes assigned task(s)	4	3	2	1
G) Flexibility - willingness to adjust to new problems and changing situations	4	3	2	1
H) Willingness to learn and work	4	3	2	1
I) Initiative - starts working on his own	4	3	2	1
J) Careful with materials and property	4	3	2	1

WORK SKILLS

A) Ability to follow oral directions	4	3	2	1	X
B) Ability to follow written directions	4	3	2	1	X
C) Ability to use proper terminology	4	3	2	1	X
D) Proper organization of work methods	4	3	2	1	X
E) Quality of work	4	3	2	1	X
F) Quantity of work	4	3	2	1	X
G) Proper use of tools and equipment	4	3	2	1	X
H) Can work without continuous supervision	4	3	2	1	X

****

Overall Achievement- Marks represent the student's individual effort and progress in relation to his/her ability.

	EXCELLENT	VERY GOOD	SATISFACTORY	IMPROVEMENT NECESSARY
ACHIEVEMENT	A	B	C	D
EFFORT	A	B	C	D

****

COMMENTS - _____

_____

_____

Pages 194 to 196 have been removed due to copyright restrictions.

Appendix E: Examples from Orientation of Dots & Orientation in Space I.

Feuerstein, R., & Jensen, M. R. (1980). Teacher's Guide to the Feuerstein Instrumental Enrichment Program. Baltimore: University Park Press.

Appendix F

PILOT STUDY

A pilot study was conducted with four second year students selected at random from one of the second year classes. The study was completed prior to the commencement of the official study with the first year students. The purpose of the study was to assess the Vocational Task design. The other measures utilized were either regularly administered by the school or standardized tests. It was imperative that any problems associated with the Vocational Task be identified and rectified prior to its application.

The procedure for the pilot study was essentially the same as that described within the body of the paper. As a result of the pilot study the error recording procedures explained in the methodology chapter were devised. The number of circuits per board was increased by two (except for the teaching board). The number of missing circuits was increased by two to make the task more difficult. The pilot sutdy also provided the information for the phrasing of the questions in the Descriptive Descrimination portion and the selection of Overt Strategies. In addition one circuit was removed due to the ambiguity of its corresponding diagram.

The changes as a result of the pilot study were minor but the information gained for recording purposes was vital.